

Wheat Nutrient Management Practices

Section 3: Phosphorus and Potassium Management Practices

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Introduction

Appropriate management of phosphorus and potassium fertilizers are important to maximizing wheat yields as well as reducing loss of these nutrients that can cause negative environmental effects. The management practices that lead to the highest chance of P and K use by the corn crop and lowest chance of loss to the environment is often referred to as the 4Rs of nutrient management—Right: source, rate, timing, and placement. In this chapter we will evaluate the results from the 2019 nutrient management survey to help us better understand the local factors that influence the use of various P and K management practices. The local factors evaluated include geographic location within South Dakota, tillage type, and farm size. Understanding these factors on farmer's decisions regarding P and K management practices can give guidance to government agencies, extension, and other professionals regarding needed research, educational resources, and trainings that are needed to help farmers adopt appropriate 4R nutrient management practices.

Phosphorus and Potassium Sources

Phosphorus

Phosphorus fertilizer source used by farmers regardless of application timing was not affected by location, tillage, or farm size. This result suggests that fertilizer sources are similarly available to farmers regardless of their location in SD and its associated annual rainfall. Tillage practices also did not affect the P fertilizer source decision. Farmers used MAP the most regardless of application timing (79%) followed by DAP (19%) and MESZ or MES (2%) (Table1).

Potassium

Potassium fertilizer source used by farmers regardless of application timing was not affected by location, tillage, or farm size. Similar to P fertilizer, this result suggests that fertilizer sources are similarly available to farmers regardless of their location in SD and similarly used regardless of tillage type or farm size. Farmers used K chloride (KCl) the most regardless of application timing (72%) followed by K sulfate (20%), K thiosulfate (5%), and K-magnesium sulfate (5%) (Table1).

Table 1. Percentage use of phosphorus and potassium source by application timing with percentage use across fertilizer sources and application timings.

Nutrient Source	Application Timing			
	Fall (%)	Spring (%)	In-season (%)	Across Timings (%)
Phosphorus				
MAP (11-52-0)	6	14	0	79
DAP (18-46-0)	1	3	2	19
MESZ or MES	0	1	0	2
Across phosphorus products	28	67	5	-
Potassium				
Potassium chloride (0-0-60)	2	9	0	72
Potassium sulfate (0-0-50)	1	2	0	20
Potassium-magnesium sulfate (0-0-22-22S-11Mg)	0	0.2	0.4	5
Potassium thiosulfate (0-0-25-17S)	0	0.6	0.2	5
Across potassium products	21	73	6	-
Note. Percentages may not add up to 100 as individuals could input data in multiple categories.				

Phosphorus and Potassium Rates

Phosphorus

Fertilizer-P rates used in wheat production were not influenced by location in SD, tillage type, or farm size (Table 2). Farms across these categories applied between 49 and 73 lbs P_2O_5 ac⁻¹. There was a trend for farms using conventional tillage to apply more P (73 lbs P_2O_5 ac⁻¹) compared to reduced and no-till farms (53-55 lbs P_2O_5 ac⁻¹), but it was not a statistically significant difference.

Potassium

Fertilizer-K rates used in wheat production were not influenced by location in SD, tillage type, or farm size (Table 2). Farms across these categories applied between 27 and 51 lbs K_2O ac⁻¹. There was a similar trend as with P rates where farms using conventional tillage applied more K (51 lbs K_2O ac⁻¹) compared to reduced and no-till farms (27-32 lbs K_2O ac⁻¹), but it was not a statistically significant difference.

Table 2. Total fertilizer-P and -K rate as affected by location, tillage system, and farm size.

Variables	Fertilizer-P rate (lbs P_2O_5 ac ⁻¹)	Fertilizer-K use (lbs K_2O ac ⁻¹)
Location		
East	55	34
Central	55	35
Tillage		
No-till	55	32
Reduced	53	27
Conventional	73	51
Farm size (ac)		
>2000	54	40
1,000-1,999	60	25
500-1,999	49	40
1-499	53	46
^a Mean values with different letters within each column for each variable category (i.e. location, tillage, and farm size) are statistically different ($P \leq 0.05$). If no letters are present, then there are no significant differences.		

Phosphorus and Potassium Application Time

There were only minimal applications of P and K fertilizers to wheat regardless of application timing (<15%) (Table 1). This low application percentage is likely due to some farmers applying P and K before their corn crop in sufficient quantities for the following years wheat crop. Unlike corn where approximately 1/3 of P and K fertilizer applications occur in the fall while more than 50% occur in the spring and only 4 to 7% occur during the growing season, P and K applications for wheat are equally likely to occur in the fall or spring (within 8%) (Table 1). In-season applications of P and K were very minimal when growing wheat (<7%). When farmers applied P or K fertilizers, they were most likely to apply enough for only the current season (16-22%) and not likely to apply for any number of seasons after that (<4%). (Table 3). For both P and K, the location of the farm in SD, size of the farm or tillage type was not related to making this fertilizer application strategy decision.

Table 3. Percentage of farmers that apply enough phosphorus or potassium for only the current growing season or for two or more growing seasons..

Phosphorus and potassium fertilizer application strategy	Phosphorus (%)	Potassium (%)
I apply enough for the current cropping season	22	16
I apply enough for the next two cropping seasons	1	3
I apply enough for the next three cropping seasons	0	0
I apply enough for longer than three cropping seasons	0	0

Phosphorus and Potassium Placement

In this survey we evaluated various placement methods of P and K when applied in the fall and spring. Whether P and K were applied in the fall or spring, the placement methods used were similar. Thus, when evaluated across application timings, broadcast, incorporated or unincorporated were the most common placement method (21-25%) with all other methods occurring less than 3% of the time (Table 4). When P and K fertilizer was applied it was most likely to be applied in the spring (24%) compared to the fall (8%) (Table 4). Regardless of location in SD, tillage type, and farm size, broadcast applications of P and K were the most common form of placement (22%). Placement of P and K fertilizers in any sort of sub surface band was rarely used when growing wheat (<5%). Thus, when fertilizing wheat with P and K it was most likely that it was broadcasted on the soil surface and equally likely that it was incorporated after with tillage or not incorporated and left on the soil surface.

Table 4. Percentage use of phosphorus and potassium fertilizer application timing by placement method along with percentage use across application timings and placement methods.

Variables	Fertilizer Application Timing		
	Fall (%)	Spring (%)	Across Timings (%)
Broadcast: incorporated	3	6	12
Broadcast: not-incorporated	1	6	10
Banding: with strip till	0	0.4	1
Banding: under the row	0	3	4
Sub-surface banding: next to row	1	2	4
Sub-surface banding: mid row	0	0.4	1
Surface banding: next to row	0	0.2	0.3
Surface banding: mid row	0	0	0
Across placement methods	8	24	-

Note. Percentages may not add up to 100 as individuals could input data in multiple categories.

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