2005
Evaluation of ODOT Water Quality Characteristics for Suitability in Herbicide Spray Applications

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In order that the information in this publication may be more useful, it was necessary to use trade names of products, rather than chemical names. As a result, it is unavoidable in some cases that similar products that are on the market under other trade names may not be cited. No endorsement of products is intended nor is criticism implied of similar products that are not mentioned.

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1. Introduction

For an herbicide treatment to be applied as a broadcast application it must be diluted in some type of carrier. Diluting the herbicide will increase total carrier per acre to allow for uniform coverage of the target. In most cases the carrier used is water, while in others it could be oil or liquid fertilizer. All ODOT broadcast applications currently use treated potable water as their carrier. This being said it is important to know what effects, if any, a particular water source may have on a particular herbicide treatment. Water quality characteristics such as pH, turbidity (soil solids), hardness (Mg, Ca), and electrical conductivity (EC) levels can have negative or positive effects on some herbicides. Many of the effects are minor and of little importance to the performance of a herbicide while other effects could potentially decrease herbicide activity or create compatibility problems. If a particular water source has water quality issues it may be easy to overcome any negative effects by incorporating buffering agents or other additives as needed (Table 1.). The first step is to determine water quality characteristics of current ODOT water sources and see if any negative issues are present.

The purpose of this annual report was to 1.) document the water quality characteristics of ODOT water sources, 2.) determine the effects, if any, on herbicides used by ODOT, and 3.) include suggested actions for ODOT personnel to address any problems.

2. Water Quality Characteristics

pH

The pH of a water source is dependent on the amount of hydrogen ions that are present. The pH from a given treated water source will fluctuate over time and is dependant on the water source itself and the treatment the water receives. A normal pH range for treated water would be between 6.5 and 8.5 (5). A water pH of 7.0 is considered neutral. A pH value below 7.0 is acid, and above 7.0 is alkaline. Water pH has a definite affect on herbicides. Herbicide solubility, persistence, and compatibility are all issues that can be affected. ODOT herbicides like Roundup, Campaign, or Vanquish will benefit from being mixed with slightly acidic water in a pH range of 6.5-6.9 (1). However, ODOT herbicides such as Oust and Outrider (sulfonyl urea family) will be susceptible to breakdown from an increase in water hydrolysis in acidic water (2). Of all the possible affects that could occur from water pH the most significant to ODOT is the affect of mixing sulfonyl urea herbicides in acidic water. Mixing herbicides such as Oust, Outrider, or Escort in water with a pH below 6.5 will significantly reduce the effectiveness if left in the water overnight. If using acidic water with these herbicides the key is to only mix the amount of herbicide that can be used in a four hour period. If there is potential for a tankload of these herbicides to be held overnight it would be necessary to buffer the water before the herbicide mixture is made.

Since water pH changes during the year it will may be necessary for some ODOT facilities to measure pH levels at their facility. There are accurate, inexpensive, and easy-to-use pH monitoring kits that can be purchased. However, we are not recommending that any ODOT facilities purchase these kits at this time. If it is necessary to modify the water pH, there are several adjuvants (specifically pH modifying adjuvants and buffering agents) available from distributors that can be used and are listed in Table 1.

Turbidity

Turbidity refers to the amount of soil solids that are suspended in water. The soil solids have the potential to adsorb (bind or tie-up) herbicides, such as Roundup, significantly reducing their effectiveness. This can be a common problem if herbicide applicators use creeks, ponds, or other surface water for there source of mixing water. If ODOT continues to use treated potable water sources as a carrier for their herbicides, they should not experience any turbidity problems. However, ODOT applicators should be aware of the problems of using surface water as their carrier source, especially if a herbicide such as Roundup will be used.

Hardness

Water is considered to be hard or soft based on the amount of Magnesium and Calcium that is present. Other minerals such as Sodium and Iron also play a part in water

hardness. Hard water will have a high level of these minerals present and when in the presence of a high pH can have a negative effect on herbicides. Herbicides such as Roundup, when used at selective ODOT rates, can show reduced effectiveness with hardness values of 350 or greater (4). The best way to prevent the negative effects from hard water is to mix only the amount of herbicide you can use within 4 hours. If this is not possible the negative effects from hard water can be overcome with the use of ammonium sulfate to lower the water pH. The effects from hard water should not be a big problem for ODOT facilities unless a water source has hardness values of 350 or higher along with pH levels of 8.0 or higher. Under these conditions the use of ammonium sulfate will likely be necessary to obtain the complete effectiveness from the use of either Roundup, Campaign, or Roundup tank mixes.

Electrical Conductivity (EC)

The sum of all the minerals dissolved in a sample of water is normally referred to as the total dissolved solids (TDS). The higher the TDS, the more electric current water can conduct. Because of this characteristic, a measure of the electrical conductivity (EC) is often used to provide a quick, economical estimate of the total dissolved solids in water. If the EC is less than 500 microsiemens/cm [µs/m], water quality problems for herbicides are very unlikely (3, 4). Similar to water hardness, high EC values (>500 µs/m) are more of a concern when present with high water pH.

Table 1. Partial listing of commercially available adjuvants and their potential effects on water quality and spray characteristics.

Adjuvant Name	**Manufacturer**	**Effect on pH**	**Other effects:**
LI-700	Loveland Products	Lowers pH	Also a surfactant
Buffer P.S.	Helena Chem. Co.	Lowers pH	
Buffer Extra Strength	Helena Chem. Co.	Lowers pH	Reduces hard water effects
Induce	Helena Chem. Co.	Lowers pH	Also a surfactant
Quest	Helena Chem. Co.	Lowers pH	Also adjusts alkalinity
Request	Helena Chem. Co.	Lowers pH	Reduces hard water effects
Accuquest	Helena Chem. Co.	Lowers pH	Reduces hard water effects, deposition aid
Interactive	Helena Chem. Co.	Lowers pH	Also a surfactant, reduces foam
AquabupH	Brewer Inter.	Lowers pH	Also a surfactant
Surfactant PH	Brewer Inter.	Lowers pH	Also a surfactant
Correct PH	Estes, Inc.	Lowers pH	Also a surfactant
Duke	Estes, Inc.	Lowers pH	
Surf King Plus	Estes, Inc.	Lowers pH	Also a surfactant
Aqua-King Plus	Estes, Inc.	Lowers pH	Also a surfactant
Ballast	Agriliance LLC	Lowers pH	
PAS-800	Drexel Chem. Co.	Lowers pH	Also a surfactant
Spray Prep Liquid	Kalo, Inc.	Lowers pH	Reduces hard water effects
Red River Ultra 92	Red River Spec.	Lowers pH	Also a surfactant
Red River 90	Red River Spec.	Lowers pH	Also a surfactant
There are a large number of products on the market that are ammonium sulfate (AMS) based and can be effectively used to lower pH. These can be purchased in a liquid or dry form. Some of these products are blends of AMS with other chemicals that modify the spray solution in ways that may or may not be of use to ODOT. Consult OSU personnel for recommendation on specific AMS based adjuvants. Some of the materials listed may not be listed on the current Approved Herbicide and Adjuvant List.			

3. Water Quality Characteristics for Division One facilities

The water quality of the samples from Division One facilities were very good. While there were differences between the March and June sampling dates within the facilities there were no data to suggest that Division One facilities should have any herbicide/water quality problems.

Table 2. Water quality characteristics for 2005 Division One water samples.

ODOT Field Division	Division Facility	Collection Date	LabID	pH	EC (µs/m)	Hardness (ppm)
1	Checotah Interstate	March/April	375183	7.6	282	80
		June/July	384544	8	494	156
1	Sallisaw Interstate	March/April	375184	7	81.61	24
		June/July	384545	7.6	87	28
1	Muskogee County	March/April	375185	7.4	263	116
		June/July	384546	7.7	327	148
1	Cherokee County	March/April	375186	7.9	262	118
		June/July	384547	8.1	293	129
1	Adair County	March/April	375187	7.7	202	101
		June/July	384548	8.1	221	116
1	Sequoyah County	March/April	375188	7.1	82.92	24
		June/July	384550	7.2	84	32
1	Haskell County	March/April	375189	7	108.4	23
		June/July	384551	7.2	127	25
1	McIntosh County	March/April	375190	7.6	278	81
		June/July	384552	7.8	315	93
1	Okmulgee County	March/April	375191	7.2	167.4	58
		June/July	384553	7.6	184	68
1	Wagoner County	March/April	375192	7.7	260	121
		June/July	384554	7.7	296	137

4. Water Quality Characteristics for Division Two facilities

The water quality of the samples from Division Two facilities were very good. While there were differences between the March and June sampling dates within the facilities there were no data to suggest that Division One facilities should have any herbicide/water quality problems.

Table 3. Water quality characteristics for 2005 Division Two water samples.

ODOT Field Division	Division Facility	Collection Date	LabID	pH	EC (µs/m)	Hardness (ppm)
2	Atoka County	March/April	370304	7.8	165.9	31
		June/July	384462	7.8	180	41
2	Bryan County	March/April	370305	8.1	272	117
		June/July	384463	8.3	472	260
2	Choctaw County	March/April	370306	7.9	106.5	18
		June/July	384464	7.8	126	32
2	Latimer County	March/April	370307	7.4	81.86	27
		June/July	384465	7.7	103	37
2	Leflore County	March/April	370308	6.8	145.1	54
		June/July	384466	7.2	150	53
2	McCurtain County	March/April	370309	6.9	137.3	53
		June/July	384467	7.4	148	56
2	Marshall County	March/April	370310	8.1	281	132
		June/July	384468	8.1	287	138
2	Pittsburg County	March/April	370311	8.3	327	36
		June/July	384470	7.7	159	37
2	Pushmataha County	March/April	370312	8	147.3	18
		June/July	384471	8	163	25
2	Talihina Yard	March/April	375182	7.8	113.2	19
		June/July	384472	7.8	122	17

5. Water Quality Characteristics for Division Three facilities

After analysis of the Division Three water samples it appears that a few facilities have the potential to have reduced herbicide effectiveness from water quality problems. The poor water quality data is not extreme but moderate and could explain why the following facilities may see slightly different weed control than those facilities that do not have the water quality problems. Purcell Interstate, Shawnee Interstate, Pontotoc County, McClain County, Johnston County, and Pottawatomie County facilities all have moderately high pH values along with moderately high EC values (Table 4). These values will likely reduce the effectiveness of products such as Roundup (active ingredient glyphosate) and Campaign; however they may actually increase the activity of Oust or Outrider. Since Division Three uses the ammonium sulfate (AMS) product with its Campaign herbicide treatment there is likely no noticeable effect from the high pH water because the AMS will lower the pH before the herbicide is added. However in applications of Roundup plus Outrider in the summer where no AMS is used, there may be loss of Roundup activity from the effect of the high pH and high EC water. The slight reduction in Roundup activity may also be masked by a slight increase in activity from the Outrider tank mix partner. We do not recommend making any modifications to the summer treatment other than to emphasize the importance that when a tank mix is made it should be applied that same day. Carrying a tank mix over night, in the aforementioned facilities, will likely result in a moderate reduction in Roundup plus Outrider activity. Other herbicides used by Division Three should not be significantly effected by water qualities.

Table 4. Water quality characteristics for 2005 Division Three water samples.

ODOT Field Division	Division Facility	Collection Date	LabID	pH	EC (µs/m)	Hardness (ppm)
3	Purcell Interstate	March/April	NA	NA	NA	NA
		June/July	385971	8.3	804	237
3	Shawnee Interstate	March/April	375181	8.3	610	252
		June/July	385972	8.1	549	230
3	Seminole County	March/April	370335	7.9	158	47
		June/July	385973	7.8	177	51
3	Pontotoc County	March/April	370336	8.3	604	237
		June/July	385974	8.2	600	370
3	Garvin County	March/April	370337	8	270	87
		June/July	385975	8	341	133
3	McClain County	March/April	370338	8.5	735	211
		June/July	385976	8.3	651	225
3	Coal County	March/April	370340	7.3	100.2	26
		June/July	385977	7.6	133	42
3	Hughes County	March/April	370341	7.5	191.6	64
		June/July	385978	7.6	219	75
3	Okfuskee County	March/April	370342	7.6	256	78
		June/July	385980	7.7	269	86
3	Johnston County	March/April	370343	8.6	504	294
		June/July	385981	8.4	403	230
3	Lincoln County	March/April	370344	8.2	355	146
		June/July	385982	7.9	399	157
3	Pottawatomie County	March/April	370346	8.4	583	231
		June/July	385983	8.1	672	243

6. Water Quality Characteristics for Division Four facilities

After analysis of the Division Four water samples, it appears that a few facilities have the potential to have reduced herbicide effectiveness from water quality problems. The poor water quality data is not extreme but moderate and could explain why the following facilities may see slightly different weed control than those facilities that do not have the water quality problem. Guthrie Interstate, Garfield County, Logan County, Grant County, Payne County, and Kingfisher County facilities all have moderately high pH values along with moderately high EC values (Table 5). These values will likely reduce the effectiveness of products such as Roundup and Campaign, however they may actually increase the activity of Oust or Outrider. Since Division Four uses the ammonium sulfate (AMS) product with its Campaign herbicide treatment, there is likely no noticeable effect from the high pH water because the AMS will lower the pH before the herbicide is added. However, in applications of Roundup plus Oust or Outrider in the summer where no AMS is used, there may be loss of Roundup activity from the effects of high pH and high EC water. The slight reduction in Roundup activity may also be masked by a slight increase in activity from the Oust or Outrider tank mix partner. We do not recommend making any modifications to the summer treatment other than to emphasize the importance that when a tank mix is made it should be applied that same day. Carrying a tank mix over night, in the aforementioned facilities, will likely result in a moderate reduction in Roundup plus Oust or Outrider activity. Other herbicides used by Division Four should not be significantly effected by water qualities.

Table 5. Water quality characteristics for 2005 Division Four water samples.

ODOT Field Division	Division Facility	Collection Date	LabID	pH	EC (µs/m)	Hardness (ppm)
4	Guthrie Interstate	March/April	370314	8.5	1243	17
		June/July	383961	8.4	1152	14
4	Tonkawa Interstate	March/April	370315	8	495	121
		June/July	383962	7.7	453	94
4	Noble County	March/April	370316	8.1	345	109
		June/July	383963	8.1	364	112
4	Garfield County	March/April	370317	8.4	754	288
		June/July	383964	8.3	686	276
4	Payne County	March/April	370318	8.3	938	134
		June/July	383965	8.3	514	214
4	Logan County	March/April	370320	8.6	1466	21
		June/July	383966	8.5	1180	15
4	Kay County	March/April	370321	8.3	503	132
		June/July	383967	7.6	452	95
4	Kingfisher County	March/April	370322	8.5	738	281
		June/July	383968	7.8	706	282
4	Grant County	March/April	370323	8.4	795	330
		June/July	383969	8.4	738	308

7. Water Quality Characteristics for Division Five facilities

After analysis of the Division Five water samples it appears that a few facilities have the potential to have reduced herbicide effectiveness from water quality problems. The poor water quality data is not extreme but moderate and could explain why the following facilities may see slightly different weed control than those facilities that do not have the water quality problem. Hydro Interstate (Geary), Elk City Interstate, Hydro Interstate, Custer County, Kiowa County, Washita County, Roger Mills County, Blaine County, and Harmon County facilities all have moderately high pH's along with moderately high EC values (Table 6). These values will likely reduce the effectiveness of products such as Roundup and Campaign, however they may actually increase the activity of Oust or Outrider. Since Division Five uses the ammonium sulfate (AMS) product with its Campaign herbicide treatment there is likely no noticeable effect from the high pH water because the AMS will lower the pH before the herbicide is added. However, in the case of applications of Roundup plus Oust or Outrider in the summer where no AMS is used, there could be loss of Roundup activity from the effects of high pH and high EC water. The slight reduction in Roundup activity may also be masked by a slight increase in activity from the Oust or Outrider tank mix partner. We do not recommend making any modifications to the summer treatment other than to emphasize the importance that when a tank mix is made it should be applied that same day. Carrying a tank mix over night, in the aforementioned facilities, will likely result in a moderate reduction in Roundup plus Oust or Outrider activity. Other herbicides used by Division Five should not be significantly effected by water qualities.

Table 6. Water quality characteristics for 2005 Division Five water samples.

ODOT Field Division	Division Facility	Collection Date	LabID	pH	EC (µs/m)	Hardness (ppm)
5	Hydro Interstate (Geary)	June/July	383970	8.3	549	257
5	Elk City Interstate	March/April	375145	8.3	681	337
		June/July	383971	8.4	660	331
5	Hydro Interstate	March/April	375146	8.3	756	290
		June/July	383972	8.2	726	265
5	Beckham County	March/April	375147	8.5	623	310
		June/July	383973	8.1	606	298
5	Custer County	March/April	375148	8.4	683	265
		June/July	383974	8.4	626	242
5	Jackson County	March/April	375150	8	785	224
		June/July	383975	8.1	744	204
5	Tillman County	March/April	375151	8	788	229
		June/July	383976	8.1	773	200
5	Kiowa County	March/April	375152	8.2	832	293
		June/July	383977	8.3	816	281
5	Greer County	March/April	375153	8.3	418	168
		June/July	383978	8.1	411	147
5	Washita County	March/April	375154	8.5	624	298
		June/July	383980	8.2	772	277
5	Roger Mills County	March/April	375155	8.6	670	236
		June/July	383981	8.4	636	192
5	Blaine County	March/April	375156	8.5	688	335
		June/July	383982	8.3	600	274
5	Dewey County	March/April	375157	7.8	266	97
		June/July	383983	8.1	263	74
5	Harmon County	March/April	375158	8.6	609	273
		June/July	383984	8.3	598	251

8. Water Quality Characteristics for Division Six facilities

After analysis of the Division Six water samples it appears that a few facilities have the potential to have reduced herbicide effectiveness from water quality problems. The poor water quality is not extreme but moderate and could explain why the following facilities may see slightly different weed control than those facilities that do not have the water quality problem. Texas County, Major County, Beaver County, Cimarron County, Ellis County and Harper County facilities all have water with moderately high pH values and moderately high EC values (Table 7). These values will likely reduce the effectiveness of products such as Roundup and Campaign. However, they may actually increase the activity of Oust or Outrider. Currently Division Six has an optional winter Campaign treatment, but if they were to return to this treatment it would be very useful to incorporate the AMS adjuvant to lower water pH levels. In applications of Roundup plus Oust or Outrider in summer, where no AMS is used, there may be loss of Roundup activity from the effects of high pH and high EC water. The slight reduction in Roundup activity may also be masked by a slight increase in activity from the Oust or Outrider tank mix partner. We do not recommend making any modifications to the summer treatment other than to emphasize the importance that when a tank mix is made it should be applied that same day. Carrying a tank mix over night, in the aforementioned facilities, will likely result in a moderate reduction in Roundup plus Oust or Outrider activity. Other herbicides used by Division Six should not be significantly effected by water qualities.

Data analysis of water samples from the Alfalfa County facility have shown moderate to high values for pH, EC, and hardness. This means the Alfalfa County facility water source has very poor water quality for mixing with herbicides. The water source may be perfectly fine for human consumption but, it very likely creates other domestic problems (difficult to launder clothing, scale buildup in pipes, etc.). We would recommend that, if at all possible, Alfalfa County try and find another water source to use and have it tested. If this is not option they will likely need to look into using an adjuvant to reduce the effects from the poor water quality (Table 1.).

Table 7. Water quality characteristics for 2005 Division Six water samples.

ODOT Field Division	Division Facility	Collection Date	LabID	pH	EC (µs/m)	Hardness (ppm)
6	Texas County	March/April	370325	8.3	641	274
		June/July	383985	8.4	533	258
6	Woodward County	March/April	370326	8.1	424	202
		June/July	383986	8.2	390	184
6	Woods County	March/April	370327	3.2	444	194
		June/July	383987	7.7	461	199
6	Alfalfa County	March/April	370328	8.4	1593	658
		June/July	383988	8.5	1490	647
6	Major County	March/April	370329	8.3	612	263
		June/July	383989	7.8	600	259
6	Beaver County	March/April	370330	8.5	607	243
		June/July	383990	8.2	636	250
6	Cimarron County	March/April	370331	8.3	585	252
		June/July	383991	8.3	553	236
6	Ellis County	March/April	370332	8.2	495	232
		June/July	383992	8.3	451	211
6	Harper County	March/April	370333	8.3	663	243
		June/July	383993	8.3	624	220

9. Water Quality Characteristics for Division Seven facilities

After analysis of the Division Seven water samples it appears that a few facilities have the potential to have reduced herbicide effectiveness from water quality problems. The poor water quality data is not extreme but moderate and could explain why the following facilities may see slightly different weed control than those facilities that do not have the water quality problem. Caddo County, Grady County, Jefferson County, Love County, and Stephens County facilities all have water with moderately high pH values and moderately high EC values (Table 8). These values will likely reduce the effectiveness of products such as Roundup and Campaign, however, they may actually increase the activity of Oust or Outrider. Since Division Seven uses the ammonium sulfate (AMS) product with its Campaign herbicide treatment there is likely no noticeable effect from the high pH water because the AMS will lower the pH before the herbicide is added. However, applications of Roundup plus Oust or Outrider in summer when no AMS is used, there is likely loss of Roundup activity from the effects pf high pH and high EC water. The slight reduction in Roundup activity may also be masked by a slight increase in activity from the Oust or Outrider tank mix partner. We do not recommend making any modifications to the summer treatment other than to emphasize the importance that when a tank mix is made it should be applied that same day. Carrying a tank mix over night, in the aforementioned facilities, will likely result in a moderate reduction in Roundup plus Oust or Outrider activity. Other herbicides used by Division Seven should not be significantly effected by water qualities.

Table 8. Water quality characteristics for 2005 Division Seven water samples.

ODOT Field Division	Division Facility	Collection Date	LabID	pH	EC (µs/m)	Hardness (ppm)
7	Caddo County	March/April	375160	8.2	511	225
		June/July	384217	8	538	239
7	Carter County	March/April	375168	8.3	404	184
		June/July	384218	8.1	438	192
7	Comanche County	March/April	375161	8.3	458	187
		June/July	384220	8.1	471	200
7	Cotton County	March/April	375162	8	366	131
		June/July	384221	8.2	421	133
7	Grady County	March/April	375163	8.1	518	227
		June/July	384222	7.9	528	250
7	Jefferson County	March/April	375164	8.2	536	209
		June/July	384223	8.1	578	225
7	Love County	March/April	375165	8.8	865	17
		June/July	384224	8.6	964	25
7	Murray County	March/April	375166	8.3	399	180
		June/July	384225	8.2	438	203
7	Stephens County	March/April	375167	8.3	546	208
		June/July	384226	8.3	608	237
7	Ardmore Interstate	March/April	375168	8.3	404	184
		June/July	384218	8.1	438	192

10. Water Quality Characteristics for Division Eight facilities

After analysis of the Division Eight water samples it appears that a few facilities have the potential to have reduced herbicide effectiveness from water quality problems. The poor water quality data is not extreme but moderate, and this could explain why the following facilities may see slightly different weed control than those facilities that do not have the water quality problem. Osage County, Ottawa County, and Creek County facilities all have moderately high pH values along with moderately high EC values (Table 9). These values may reduce the effectiveness of products such as Roundup and Campaign, however they may actually increase the activity of Oust or Outrider. Since Division Eight uses the ammonium sulfate (AMS) product with its Campaign herbicide treatment there is likely no noticeable effect from the high pH water because the AMS will lower the pH before the herbicide is added. However, in applications of Roundup plus Oust or Outrider in summer, where no AMS is used, there may be loss of Roundup activity from the effects of high pH and high EC water. The slight reduction in Roundup activity may also be masked by a slight increase in activity from the Oust or Outrider tank mix partner. We do not recommend making any modifications to the summer treatment other than to emphasize the importance that when a tank mix is made it should be applied that same day. Carrying a tank mix over night, in the aforementioned facilities, will likely result in a moderate reduction in Roundup plus Oust or Outrider activity. Other herbicides used by Division Eight should not be significantly effected by water qualities.

Table 9. Water quality characteristics for 2005 Division Eight water samples.

ODOT Field Division	Division Facility	Collection Date	LabID	pH	EC (µs/m)	Hardness (ppm)
8	Craig County	March/April	375170	7.7	281	134
		June/July	383994	8.1	305	131
8	Nowata County	March/April	375171	8.2	479	236
		June/July	383995	7.9	200	78
8	Osage County	March/April	375172	8.4	483	225
		June/July	383996	8.2	325	135
8	Ottawa County	March/April	375173	8.2	760	160
		June/July	383997	8.3	392	119
8	Washington County	March/April	375174	7.9	285	128
		June/July	383998	7.9	203	76
8	Rogers County	March/April	375175	7.8	220	77
		June/July	384000	7.4	257	82
8	Delaware County	March/April	375176	8.1	249	121
		June/July	384001	7.8	200	73
8	Pawnee County	March/April	375177	8	230	103
		June/July	384002	8	57	97
8	Mayes County	March/April	375178	8.1	471	194
		June/July	384003	7.7	400	138
8	Creek County	March/April	375180	8.5	484	243
		June/July	384004	8.5	488	229

11. Summary of ODOT Water Quality Characteristics for Mixing with Herbicides

When you look at water quality data that has been created as a result of the 2005 sampling effort, it appears to have a great deal of variability. Considering that water samples were submitted from every county in Oklahoma, the water quality data is actually very similar. This is likely a direct result of ODOT using treated potable water from the various municipalities across the state. If ODOT county and interstate facilities were using water from on-site wells or untreated surface impoundments we would likely have had a much higher incidence of poor water quality that would be of concern.

Overall the water quality was good for all of the field divisions with no major problems being observed (Exception Alfalfa County/Div. 6). As would be expected, the water quality in the eastern portion of the state was better than in the western areas. As would also be expected in Oklahoma, considering our native minerals and soils, most of our water will have a pH in the range of 7.5-8.5. This slight to moderately alkaline water will undergo a reduction in pH (1.0-1.5 units) as we combine our slightly acidic herbicides, surfactants, and ammonium sulfate. This drop in pH, from our routine herbicides and adjuvants, will benefit all of our Roundup Pro Concentrate (glyphosate), Campaign (glyphosate + 2, 4-D amine), and Vanquish (dicamba) applications across the state as they benefit from being mixed in slightly acidic or neutral water carriers. This drop in pH will also offset some of the antagonism that may be occurring from hard water sources. On the other hand, some of herbicides in the sulfonyl urea family, such as Oust (sulfometuron) or Outrider (sulfosulfuron) will actually begin to breakdown quicker in the tank under acidic conditions. This is not a major concern unless water pH levels were to drop below 5.5. Considering the current pH values of ODOT water sources it is unlikely that pH levels would drop to this point considering normal herbicide use. The only way to know for sure the pH value achieved after mixing would be for the applicators to test the tank-mix pH on site.

Unless a person has the benefits of using a soft water source with a pH of 7.0 (neutral) they will always contend with having some level of potential effect on their herbicides performance. Since ODOT water quality problems are slight in nature, it would not likely pay dividends to invest funds in buffering ODOT water sources. There are a number of ODOT facilities that were listed in the text of this report as having moderately poor water quality. It is critical in these facilities that all herbicides be mixed and sprayed in the same day, preferably in the same half-day. This is most important when using Oust, Outrider, or Escort herbicides. This should not be a big problem for ODOT crews as it has always been a point of emphasis in herbicide training classes to try and prevent carrying over herbicides from day to day. This was mainly due to keeping the herbicides agitated in the tank properly but now there is even more reason to follow this recommendation in that the herbicides are likely undergoing more breakdown in the tank than first expected. In cases where ODOT crews mix up small quantities of herbicides to do hand-gun applications or spot-treat applications, there is a bigger chance that herbicides may be left in the tank overnight or longer. Under these conditions, and if using products like Vanquish or Overdrive, we likely need to look at acidifying the water with AMS or buffering it with one of the commercially available products (Table 1.).

This would add a small cost to the application but would prevent the herbicide from breaking down in the tank which would result in poor weed control.

MSMA, alone or combined with other herbicides, is commonly used by certain ODOT field divisions for summer johnsongrass and broadleaf weed control. Under certain conditions water with high levels of Mg, Ca, and Fe (positively charged cations) can cause precipitates to form in the tank. This will likely cause a reduction in weed control and the evidence of the precipitates would be noticeable in the tank. If any ODOT facilities whom are using MSMA have noticed precipitates (small flakes) in the tank after spraying they can use one of the commercially available products to reduce the negative effects of the hard water that is likely the cause. Buffering the water pH alone may not help, an adjuvant must be used that is designed to reduce hard water effects (Table 1).

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