UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

FIELD CROP NOTES

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In this Issue:

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Spring Farming Tips in a Drought Year

While recent rains have provided some much needed precipitation, unfortunately it still looks like this will be a dry year unless there is a dramatic turnaround. Snowpack surveys have shown a significant improvement compared with what they were just a month ago but we still have a ways to go. What happens through the rest of March and into early April can have a large effect. Regardless of exactly what kind of year it ends up being, it is always a good idea to plan ahead. Below are some tips to consider for spring planning.

- **Begin monitoring soil moisture in March**. If winter precipitation does not refill the soil profile (which is likely the case this year), consider irrigating earlier than normal to refill the soil profile. This tip is especially important for deep-rooted perennial crops like alfalfa. Irrigating in the spring to refill the soil profile can help avoid drought stress later in the growing season. Most irrigation systems in the Intermountain Region are barely able to keep up with crop water use and do not have the capacity to refill a depleted soil profile during the summer months. This is especially true for wheel-line systems with a ratio of one wheel-line per 30 or 40-acres. Deep soil moisture is important because it is usually needed to carry the crop through peak water use periods in mid summer.
- **Use soil moisture sensors**. The tip above emphasizes the importance of filling the soil profile to at least 3 or 4 feet in spring. However, how do you know the moisture status at the lower levels of the root zone? Soil moisture sensors (the most common one we have worked with is the Watermark sensors from Irrometer) have proven to be an extremely valuable tool to determine the soil moisture status deeper in the soil profile. Using a tool like soil moisture sensors is especially beneficial in drought years to know the depth to which winter rains have wet the soil, to decide when to start irrigating, and to know the soil depth reached with each irrigation.
- **Irrigate for high spring production for alfalfa.** Alfalfa yield is typically highest in spring and tends to decrease with each successive cutting for the remainder of the season. Alfalfa forage quality is

also higher in spring than in mid summer. Averaging results from years of alfalfa variety tests indicated that the first cutting represented 42 percent of the total production for a 3-cut schedule and 35 percent for a 4-cut schedule. Full irrigation into July would provide sufficient water for normal production for the first two cuttings of a 4-cut schedule—61 percent of the annual production. Seventy-five percent of the seasonal production occurs in the first two cuttings of a 3-cut schedule (irrigation up to mid-July). Therefore, when water supplies for the season are inadequate, it is best to irrigate fully in the spring if possible rather than spread the limited water over the full season.

- **If practical, allow for some late summer irrigation of pastures.** Alfalfa is better able to withstand deficit irrigation than pasture grasses. When moisture is severely limiting, alfalfa goes into a drought-induced dormancy, ceases growth and will normally recover to produce full yields the next year. Grasses are not as drought tolerant and stand can be lost if irrigation water is withdrawn too early and soil moisture reserves are insufficient. If soil moisture content is extremely low and some irrigation water is available, it may be beneficial to provide some irrigation, even if only a partial irrigation, in late August to avoid stand loss.
- **Consider avoiding crops that require full-season irrigation water** such as spring-planted alfalfa or perennial grasses if you depend on water from an irrigation district. Spring-seeded barley, wheat, or triticale cut at the boot or soft-dough stage makes a good forage crop that requires less water. Barley matures earlier than wheat and may get by with one less irrigation. Triticale because of its rye background and extensive root system generally performs better than wheat or barley under moisture-limiting conditions.
- **Fertilize adequately for the expected length of the growing season**. Estimate how long you will be able to irrigate and the anticipated yield and fertilize accordingly. It doesn't make sense to apply the full amount of fertilizer if the yield will be cut in half because of insufficient water. However, on the other side, many growers tend to under fertilize their pastures. If water is going to be scarce, you don't want inadequate fertilizer in the spring to limit yield and spring is typically when you get the greatest response to applied fertilizer. Therefore, make sure you have adequate fertilizer for maximum yield for the time period when water is adequate but not beyond.
- **Scout for weeds and insects early in the season**. Controlling weeds in the seedling stage usually results in the best weed control and prevents weeds from taking moisture away from the crop. Also you don't want to sacrifice yield from insects like the alfalfa weevil when water is the most limiting factor. The alfalfa weevil is more damaging in a drought stressed crop.

Alfalfa Variety Selection

One of the most common questions I am asked is: "Which alfalfa variety is the best for this area?" First off, there is no single "best" variety. Breeding companies have come a long way in their efforts to produce high yielding, high quality varieties with good pest resistance. Therefore, there are several high producing varieties to choose from. Factors that should be considered include selecting the proper fall dormancy (fall dormancy rating of 3 to 5 is typically best for this area), a variety with resistance to the most prevalent pests in your area, and perhaps most importantly select a variety among the top yielding varieties. These factors should be the primary consideration when selecting a variety rather than the price of the seed. Which pests are important depends on your location and is not the same throughout the county. For example, stem nematode is a serious problem in Scott and Shasta Valleys and is less important in Butte Valley and the Tulelake area.

The importance of selecting a well adapted variety should not be underestimated. It is a decision you must live with for at least five to seven years (although it may be shorter if you select the wrong variety). The difference in annual yield between varieties multiplied over the life of the stand can be quite significant. In the Scott Valley trial (Table 1), the difference between the top variety and the lowest yielding variety, Vernal, averaged 1.5 tons. That difference over a 7 year stand life is 10.5 tons. Fortunately, most growers have realized that Vernal is such a low yielding variety and no longer plant it. However, the difference between the top yielding varieties and those in the middle of the pack is still around 0.5 tons, which multiplied over a 7 year stand life is 3.5 tons or around $525 assuming $150 per ton hay.

Variety trials are conducted in Scott Valley and Tulelake by UC Cooperative Extension to help identify which varieties perform best in the Intermountain area. The following pages show the results for trials planted in 2006 in Scott Valley and planted in 2004 at the Intermountain Research and Extension Center (IREC) in Tulelake. A new trial was planted in the late summer of 2007 at IREC (data not shown because the trial has just been harvested for one year and variety selection should not be based on a single year's data). Data can be seen by going to the following website alfalfa.ucdavis.edu. When selecting a variety, choose one amongst the upper group of varieties (approximately upper one third or so) in the tables with the pest resistances needed for your area.

Many growers are wondering about the availability of Roundup Ready (RR) alfalfa varieties. As you are probably aware, there was a court ordered injunction in May of 2007 prohibiting planting of RR alfalfa. USDA APHIS is currently evaluating the potential impacts of

RR alfalfa on the environment (primarily the potential for Roundup resistant weeds and movement of the RR trait from RR fields to conventional non RR fields or organic fields). As of yet, the draft EIS is not ready for publication/comment but it should be soon. Earlier it was thought that maybe plantings could occur as early as this fall but now that is doubtful. So, whether or not to plant RR alfalfa likely won't be an issue for this year.

TABLE 1. 2006-2008 YIELDS, UC SCOTT VALLEY ALFALFA CULTIVAR TRIAL. TRIAL PLANTED 5/04/06

		2006 Yield	2007 Yield	2008 Yield	Average		% of Vernal
	FD		Dry t/a				%
Integra 8400	4	4.6 (21)	9.1 (1)	8.8 (1)	7.5 (1)	A	123.8
Xtra-3	4	5.5 (1)	8.7 (2)	8.0 (13)	7.4 (2)	A B	122.8
Dura 512	5	4.9 (6)	8.4 (11)	8.7 (3)	7.3 (3)	A B C	121.3
PGI 459	4	4.7 (15)	8.4 (6)	8.7 (2)	7.3 (4)	A B C D	120.7
Rebound 5.0	4	4.8 (12)	8.4 (7)	8.7 (4)	7.3 (5)	A B C D E	120.6
DS417	4	5.3 (2)	8.4 (8)	8.0 (17)	7.2 (6)	A B C D E F	119.9
FSG 505	5	4.6 (19)	8.6 (3)	8.3 (7)	7.2 (7)	A B C D E F	118.9
MasterPiece	4	4.8 (11)	8.6 (4)	8.0 (14)	7.1 (8)	B C D E F G	118.2
Masterpiece	4	4.7 (17)	8.3 (14)	8.3 (6)	7.1 (9)	B C D E F G	117.5
GrandStand	4	4.2 (30)	8.4 (9)	8.6 (5)	7.1 (10)	C D E F G H	117.0
Mountaineer 2.0	5	4.8 (10)	8.4 (12)	8.0 (16)	7.1 (11)	C D E F G H	117.0
Power 4.2 (PI + Alleg)	4	4.6 (23)	8.6 (5)	8.0 (19)	7.0 (12)	C D E F G H	116.6
CW 500	5	4.8 (8)	8.2 (23)	8.1 (12)	7.0 (13)	C D E F G H I	116.2
WL 325HQ	4	4.6 (20)	8.3 (19)	8.1 (11)	7.0 (14)	C D E F G H I	115.9
WL 357HQ	5	4.9 (5)	8.2 (21)	7.8 (24)	7.0 (15)	C D E F G H I	115.8
Power 4.2 (Coated)	4	4.7 (16)	8.3 (15)	7.8 (23)	7.0 (16)	D E F G H I J	115.2
AmeriStand 407TQ	4	4.4 (27)	8.3 (17)	8.2 (8)	7.0 (17)	D E F G H I J	115.2
Boulder	5	4.6 (22)	8.4 (13)	7.9 (20)	7.0 (18)	E F G H I J	115.1
HybriForce620	6	5.1 (4)	8.2 (22)	7.5 (26)	7.0 (19)	F G H I J K	115.0
Whitney	4	4.6 (18)	8.3 (18)	7.9 (21)	6.9 (20)	F G H I J K	114.8
PGI 424	4	4.9 (7)	8.4 (10)	7.5 (28)	6.9 (21)	F G H I J K L	114.7
DKA50-18	5	4.5 (25)	8.3 (16)	8.0 (15)	6.9 (22)	F G H I J K L	114.5
WL 319HQ	3	4.5 (26)	8.1 (25)	8.2 (9)	6.9 (23)	F G H I J K L	114.5
Expedition	5	4.5 (24)	8.1 (26)	8.0 (18)	6.8 (24)	G H I J K L	113.2
Mariner III	4	4.8 (9)	8.2 (20)	7.2 (29)	6.8 (25)	H I J K L M	111.7
WL 355RR	4	4.8 (13)	7.8 (29)	7.5 (27)	6.7 (26)	I J K L M	110.8
RRALF 4R200	4	4.0 (32)	7.8 (28)	8.1 (10)	6.7 (27)	J K L M	110.0
WL 343HQ	4	4.1 (31)	7.9 (27)	7.8 (22)	6.6 (28)	K L M	109.6
HybriForce420/wet	4	5.2 (3)	8.1 (24)	6.5 (31)	6.6 (29)	L M	109.3
DKA41-18RR	4	4.3 (29)	7.5 (31)	7.7 (25)	6.5 (30)	M	107.7
FSG 408DP	4	4.7 (14)	7.8 (30)	6.8 (30)	6.4 (31)	M	106.5
Vernal	2	4.4 (28)	7.5 (32)	6.2 (32)	6.0 (32)		100.0
MEAN		4.69	8.26	7.91	6.95		
CV		8.5	4.0	6.1	4.0		
LSD (0.1)		0.48	0.40	0.58	0.33		

Trial seeded at 25 lb/acre viable seed at Scott Valley, CA.

Entries followed by the same letter are not significantly different at the 10% probability level according to Fisher's (protected) LSD.

FD = Fall Dormancy reported by seed companies.

TABLE 2. 2004-2007 YIELDS, UC TULELAKE ALFALFA CULTIVAR TRIAL. TRIAL PLANTED 5/21/04

	FD	2004 Yield	2005 Yield	2006 Yield	2007 Yield	Average		% of Vernal
				Dry t/a				
Released Varieties								
Expedition	5	5.3 (6)	9.1 (2)	9.1 (10)	7.8 (5)	7.8 (1)	A	110.4
WL357HQ	5	4.9 (30)	8.9 (6)	9.2 (3)	8.0 (1)	7.8 (2)	A B	109.9
Xtra-3	4	5.1 (23)	9.2 (1)	9.4 (1)	7.4 (22)	7.8 (3)	A B C	109.6
DS309Hyb	4	5.2 (10)	8.8 (16)	9.1 (9)	7.9 (3)	7.8 (4)	A B C D	109.4
Rebound 5.0	4	5.2 (16)	8.9 (7)	9.3 (2)	7.5 (17)	7.7 (5)	A B C D	109.4
Alfa Star II	4	5.2 (18)	8.9 (8)	9.2 (4)	7.7 (9)	7.7 (6)	A B C D	109.4
WL319HQ	3	5.1 (25)	8.9 (9)	9.0 (11)	7.8 (6)	7.7 (7)	A B C D E	108.7
WL325HQ	4	5.3 (7)	9.0 (5)	9.2 (5)	7.3 (26)	7.7 (8)	A B C D E F	108.5
MasterPiece	4	5.2 (12)	8.8 (15)	9.1 (8)	7.6 (13)	7.7 (9)	A B C D E F	108.4
Recover	5	5.2 (9)	8.8 (12)	8.9 (20)	7.7 (8)	7.7 (11)	A B C D E F G	108.1
Vitro	3	5.2 (13)	8.7 (17)	9.1 (7)	7.5 (15)	7.6 (12)	A B C D E F G	107.9
Mountaineer 2.0 (4M124)	5	5.4 (1)	8.8 (13)	8.9 (17)	7.4 (23)	7.6 (13)	A B C D E F G	107.9
C 316 Lot9078	4	4.9 (31)	9.0 (4)	9.1 (6)	7.5 (18)	7.6 (14)	A B C D E F G	107.9
LegenDairy 5.0	3	4.9 (32)	8.9 (11)	9.0 (12)	7.7 (7)	7.6 (15)	A B C D E F G H	107.6
Boulder (4M125)	5	5.0 (27)	8.9 (10)	8.9 (18)	7.6 (10)	7.6 (16)	A B C D E F G H I	107.3
Dura 512	5	5.0 (29)	8.6 (19)	8.9 (19)	7.9 (4)	7.6 (17)	A B C D E F G H I J	107.0
Hybriforce-420/Wet	4	5.2 (15)	8.6 (18)	8.8 (22)	7.5 (19)	7.5 (19)	B C D E F G H I J K	106.4
54Q25	4	5.1 (21)	8.5 (21)	9.0 (15)	7.5 (21)	7.5 (20)	C D E F G H I J K L	106.2
Blazer XL	3	5.0 (28)	8.3 (28)	8.7 (26)	8.0 (2)	7.5 (21)	D E F G H I J K L	105.9
LM 459 WD	5	5.1 (20)	8.4 (24)	8.7 (27)	7.6 (11)	7.5 (22)	E F G H I J K L M	105.3
DS218	6	5.2 (14)	8.5 (22)	8.7 (25)	7.4 (25)	7.4 (23)	F G H I J K L M	105.1
CW5440	4	5.1 (24)	8.4 (25)	8.7 (24)	7.5 (16)	7.4 (24)	F G H I J K L M N	104.9
SW435(SW4A135)	4	5.2 (17)	8.6 (20)	8.5 (32)	7.3 (27)	7.4 (25)	G H I J K L M N	104.7
Reward II	4	5.0 (26)	8.3 (27)	8.8 (21)	7.3 (29)	7.4 (27)	H I J K L M N	104.1
9429	4	4.8 (34)	8.3 (30)	8.9 (16)	7.5 (20)	7.4 (28)	I J K L M N	103.9
Magna601	6	5.3 (5)	8.4 (26)	8.6 (29)	6.9 (35)	7.3 (30)	K L M N O	103.3
Plumas	4	4.8 (33)	8.1 (33)	8.6 (30)	7.6 (12)	7.3 (31)	L M N O	102.7
Innovator +Z	3	4.8 (35)	8.3 (29)	8.4 (35)	7.3 (28)	7.2 (34)	N O P	101.4
Vernal	2	4.7 (36)	8.0 (35)	8.4 (33)	7.3 (31)	7.1 (35)	O P	100.0
Experimental Varieties								
CW94023	4	5.2 (19)	9.0 (3)	9.0 (13)	7.6 (14)	7.7 (10)	A B C D E F	108.4
CW05009	5	5.1 (22)	8.8 (14)	9.0 (14)	7.4 (24)	7.6 (18)	B C D E F G H I J K	106.8
SW5329	5	5.2 (11)	8.4 (23)	8.5 (31)	7.3 (30)	7.4 (26)	H I J K L M N	104.1
SW5307	5	5.4 (2)	8.2 (31)	8.8 (23)	7.0 (34)	7.3 (29)	J K L M N O	103.4
SW4328	4	5.2 (8)	8.0 (34)	8.7 (28)	7.1 (32)	7.3 (32)	L M N O	102.7
SW4310	4	5.4 (3)	8.1 (32)	8.4 (34)	7.1 (33)	7.2 (33)	M N O	102.2
SW6330	6	5.3 (4)	7.8 (36)	8.0 (36)	6.7 (36)	7.0 (36)	P	98.1
MEAN		5.12	8.59	8.85	7.47	7.51		
CV		5.4	4.9	4.6	5.8	3.1		
LSD (0.1)		0.29	0.45	0.44	0.46	0.25		

Trial seeded at 25 lb/acre viable seed at UC Intermountain Research and Extension Center, Tulelake CA.

Entries followed by the same letter are not significantly different at the 10% probability level according to Fisher's (protected) LSD.

FD = Fall Dormancy reported by seed companies.

Getting the Most Out of a Glyphosate (Roundup) Application

A lot of attention is paid to how much Roundup to put in the tank when controlling perennial weeds, taking out an old stand, or killing volunteer grain prior to planting in the spring. However, most people do not pay enough attention to what else to put in the spray tank. A nonionic surfactant can improve weed control with Roundup. Whether or not a surfactant is necessary depends on the formulation of glyphosate so be sure to read the label carefully to see if the addition of a nonionic surfactant is recommended.

Another additive that is often left out is dry ammonium sulfate. Again, read the label carefully, but most if not all formulations mention that the addition of dry ammonium sulfate at 1 to 2 percent by weight (8.5 to 17 lb/100 gal) might improve control. **Why does adding ammonium sulfate to glyphosate oftentimes improve control?** Hard water is one reason. Adding ammonium sulfate to the spray tank before adding the Roundup alleviates problems caused by hard water. "Hard water" contains high levels of calcium (Ca), magnesium (Mg), and/or sodium (Na) which reduce the activity of glyphosate. Ca, Mg, and Na bind with the glyphosate molecule affecting uptake and rendering it ineffective because it is no longer able to bind to its site of action in the plant. However, when ammonium sulfate is added to the spray solution, the ammonium preferentially attaches to glyphosate molecule preventing the tie-up with Ca, Mg and Na. When ammonium attaches to the glyphosate molecule it can still perform normally solving the negative effects of the hard water. Also, the sulfate in ammonium sulfate binds with some of the Ca and Mg so it cannot bind with the glyphosate. Ammonium Nitrate (28% liquid nitrogen) will also improve the effectiveness of glyphosate, but not as well as ammonium sulfate

As mentioned, the amount of ammonium sulfate to add ranges from 8.5 to 17 pounds per 100 gallons of water. How much is actually needed depends on how hard the water is. A laboratory analysis can determine the degree of water hardness. An equation was developed by North Dakota State University to more precisely determine the amount of ammonium sulfate to add.

Ammon. Sulfate (lbs./100 gal) = 0.005*ppm Na + 0.002*ppm K + 0.009*ppm Ca + 0.014*ppm Mg

Even if you don't have time to do a water analysis, it is a good idea to add ammonium sulfate (within the recommended range) to the spray solution. Ammonium sulfate is an inexpensive way to improve control. However, it is a good idea to have the water analyzed for future reference if possible.

Even if you don't have hard water, there still may be an advantage to adding ammonium sulfate. The addition of ammonium sulfate can help with the uptake of glyphosate by some weeds. Some plants have high calcium levels between the plant cells which can affect how glyphosate functions inside the plant. For example, some weeds like velvetleaf, lambsquarters, and others have specialized hairs (thrichomes) and chalk glands on the leaf surface that contain calcium, which will interfere with Roundup if ammonium sulfate is not added. A significant improvement in quackgrass control has also been found with the addition of ammonium sulfate. This is one of our most serious weed problems and is extremely difficult to completely control so any improvement in control is welcome. If using ammonium sulfate, add it to the tank first and completely dissolve before adding the surfactant or Roundup.

How Much Nitrogen Fertilizer Should You Apply to Your Spring Cereal Crop?

There has been a standard answer to this question that has evolved over the years. The typical answer has been to apply 100 pounds of actual N per acre (about 475 pounds of ammonium sulfate or 220 pounds of urea). One-hundred pounds of N is a nice round number but is it actually the correct answer? And, is it the correct answer for all sites? My personal opinion is that it is a decent ballpark figure of how much N to apply. However, just like with other nutrients, the amount of fertilizer needed is not the same for all fields. Fields differ tremendously in their fertility status based on the inherent fertility of the field, organic matter content, previous crop, past fertilization practices, and even water source. Given the projected commodity prices for this year, it makes more sense than ever to fertilize wisely for maximum return on your investment. You

don't want to apply fertilizer in excess of crop needs, while at the same time under-fertilization is costly in terms of lost yield.

When deciding how much nitrogen fertilizer to apply, a logical first step is to consider how much N is removed by the crop. Most of the grain crops grown in Scott, Shasta and Butte Valley are used for forage rather than grain; so this article will focus on forage crops. The amount of nitrogen removed per ton of small grain forage harvested at the soft dough stage typically ranges from 25 to 38 pounds of N. The amount of N removed for different yield levels is presented in the table below. However, not all the N fertilizer applied is taken up by the crop, and the crop is able to get some of its nitrogen needs from nitrogen in the soil.

Table 1

Forage Yield (tons/A)	Lbs N removed per acre
3-ton	75 to 114
4-ton	100 to 152
5-ton	125 to 190

Soils can differ dramatically in the amount in the amount of nitrogen they can supply. Therefore, 100 pounds of N is not the appropriate rate for all fields! So how do you know how much to apply? First, consider the previous crop—was it a grain crop, an old pasture, or alfalfa? Alfalfa, as a legume fixes nitrogen from the air and a portion of that nitrogen is available to the crop that is planted after alfalfa is removed (commonly referred to as a nitrogen credit). How much nitrogen should the alfalfa be credited? The general consensus in California is that a grain crop needs 40-60 lb N/acre less following alfalfa than it would following grain or some other non-legume annual crop. The time of year when the alfalfa stand is removed is also a factor. More nitrogen is released to the following crop when the alfalfa is plowed under in the fall than when it is plowed under in the spring because it has had more time to decompose.

Soil tests taken in the spring before planting can also help predict the nitrogen fertilizer needs of the grain crop. Organic matter in the soil is gradually mineralized and the nitrogen becomes available to the crop. An estimate would be that the grain crop receives 30-40 lbs of N per acre for each percent of organic matter. Laboratories also analyze for nitrate-nitrogen. This is a figure on soil test reports that we often ignore in Siskiyou County. However, it can be useful to predict how much nitrogen fertilizer the crop might need. The sample should be taken in the spring before planting. It is not like other nutrients where a fall soil sample is fine. A lot can happen to nitrate-N over the winter (leaching and denitrification). How do you interpret soil nitrate-N data? The following is a useful starting point for interpreting laboratory values on nitrate-N. A more accurate assessment can be done using the information presented on the following page prepared by Bob Hutmacher (UC Extension Specialist). Nitrate N values over 20ppm would be considered very high and the grower could probably get by with only around 50 lbs of N per acre from fertilizer.

Nitrate-N Category	Soil Analysis Nitrate-N	Nitrate-N lbs per acre
	(average for 0-24 inch depth)	
LOW	< 5-6	35-40 lbs
MODERATE	6 to about 10	40-75 lbs
HIGH	> 10 ppm	greater than about 75 lbs

So…how do you use this information to know how much nitrogen fertilizer to apply? Assess your yield potential and how much N the crop will actually remove (table 1). Then consider the previous crop. If it was alfalfa, reduce the nitrogen fertilizer you apply by about 40 to 60 pounds per acre. If you have sufficient time for a spring soil analysis, look at the organic matter content and allow 30 to 40 pounds of N for each percent organic matter. Use the nitrate-N values and consider the table above to estimate how much N the crop can take up from soil nitrate. Overall, I still think 100 pounds of N is a decent starting point but could be much higher or lower based on the specifics of your field. You could end up saving money on fertilizer or increasing your yield considerably depending on the status of your individual field.

SOIL NITRATE CALCULATIONS: When you receive soil or irrigation water test results, take note of how the results are reported – it might be reported as parts per million of nitrate-N (NO_3-N) or as parts per million nitrate (NO_3). The difference is that ppm NO_3-N means ppm nitrogen in the nitrate form, while ppm NO_3 means ppm expressed as nitrate.

SOIL NITRATE versus SOIL NITRATE-N – Rough Calculations (no corrections for different soil bulk density)		
Soil Nitrate reported as:	Multiply by:	To Get (approximately):
ppm NO_3-N	4	Lbs N/acre in 12 inch depth sample
ppm NO_3	0.903	Lbs N/acre in 12 inch depth sample
ppm = parts per million		

- *Note that the above table shows lbs N/acre per 12 inch sampling depth; if you have an average for 6 inch depth multiply by 6/12 (0.5); if you have an average ppm for 24 inch depth, multiply by 24/12 (by 2) to determine lbs N/acre for the depth sample represents*

More Accurate Calculations for Converting Soil Nitrate Concentrations (ppm) to Lbs N as NO_3-N/acre:
Information needed:

- Depth of soil sampled
- Bulk density of soil (g/cm3)
  - Range for many soils is about 1.2 to 1.45 g/cm^3
- Soil nitrate reported as NO_3-N in parts per million (ppm)

Calculation Method:

- Lbs NO_3-N/acre = 0.226 x (soil extract NO_3-N, *in ppm*) x (soil sample depth, *in inches*) x (bulk density, *in grams/cm^3)*

Example Calculation (using this method)

- Depth of soil sampled = 12 inches
  - Bulk density of soil (g/cm3) = 1.35 g/cm^3
- Soil nitrate reported as NO_3-N = 20 ppm
- Lbs NO_3-N/acre = 0.226 x (20 ppm soil extract NO_3-N) x (12 inches) x 1.35 g/cm^3
  = 73 lbs N/acre as NO_3-N

ACCOUNTING FOR IRRIGATION WATER NITRATE
Calculations - Converting Irrigation Water Nitrate Concentrations (ppm) to Lbs N per acre inch of water

IRRIGATION WATER NITRATE versus NITRATE-N – Rough Calculations		
Irrigation Water Nitrate reported as:	Multiply by:	To Get (approximately):
ppm NO_3-N	0.23	Lbs N/acre-inch of water
ppm NO_3	0.052	Lbs N/acre-inch of water
ppm = parts per million		

- *Note – if reported as mg/liter, one mg/L in solution can be considered equal to 1 ppm*

FIELD CROP NOTES

DATED MATERIAL

Cooperative Extension
University of California
1655 South Main Street
Yreka, CA 96097

NON-PROFIT
STANDARD MAIL
PERMIT #3
YREKA, CA