# Exercise 7

**Vitamin and Mineral Premixes 15 points**

Many livestock producers who feed a large number of animals each year find it economical to buy vitamin and mineral premixes or to prepare their own vitamin‐mineral premixes versus purchasing a more expensive, commercially prepared supplement which may contain protein, minerals and/or vitamins. The principle of premixes is to get the **micro‐ingredients** thoroughly mixed with a **carrier feed** to form the premix. The premix can then be added to basal ingredients and finally mixed. This procedure prevents occurrences of pockets of micro‐ ingredients within a batch of feed and allows for an even distribution of the micro‐ingredients throughout the batch. Ground grains, such as corn, and loose salt are commonly used as carrier ingredients of a premix (ie. a trace mineralized salt purchased from a feed manufacturer often contains about 98 percent salt and 2 percent trace mineral ingredients – copper sulfate, sodium selenite, etc). The objectives of this laboratory exercise are to: 1) learn to evaluate nutritional adequacy of premixes and 2) to learn how to prepare vitamin and mineral premixes to be used subsequently in a complete mixed ration. Also, below are some commonly required conversion factors:

**To change from To Multiply by**

|  |  |  |
| --- | --- | --- |
| pounds | grams | 454 |
| grams | milligrams | 1000 |
| grams/ton | parts/million | 1.1 |

# Premix Formulation ‐ Example:

You are to formulate a premix which among other things will contain supplemental iron. The premix will be added to the ration at a rate of 20 pounds per ton of complete mixed feed. The ration should contain .005% Fe. The source of the Fe for the premix is 28% Fe.

Step 1. Determine how much of the micronutrient is required per ton:

.00005 Fe x 2000 lb/ton = .10 lbs Fe required per ton of feed

Step 2. Determine how much of the micronutrient is contained in the basal ingredients:

Basal ingredients = 2000 lbs/ton ‐ 20 lbs premix/ton = 1980 lbs/ton. Upon reviewing the feed ingredient tables it is determined that the basal ingredients are .002% Fe

1980 lbs x .00002 Fe = .0396 lbs Fe in basal ingredients

Step 3. Subtract the amount of micronutrient in the basal ingredient from the requirement to obtain the amount of the nutrient that is deficient.

.10 lbs Fe required ‐ .0396 lb = .0604 lb Fe deficient/ton

Step 4. Determine the concentration of the micronutrient in the compound you are adding to the premix:

Fe source is 28% Fe

Step 5. Divide the amount of micronutrient deficient by the concentration of the nutrient in the compound:

Amt of nutr def = Amt compd to add to premix content of nutr in compound

.0604 lb Fe/.28 Fe in compound = .2157 lbs of compound to add to each 20 lbs of premix.

Example 2:

You want to formulate a premix that will be included at 10 lb/ton of ration (.5% of ration) for finishing beef cattle. You want the final ration to contain 1000 IU of vitamin A per lb of ration and 5 mg of antibiotic (AB) per lb of ration.

Step 1. Vit A = 1000 x 2000 = 2,000,000 IU per ton of ration (or per 10 lb of premix) AB = 5 mg x 2000 = 10,000 mg = 10 g per ton of ration (or per 10 lb of premix)

Step 2. Assume no Vit A in the ration and no AB. Step 3‐4. Given

Step 5.

Vitamin A source required per ton of ton (10 lb of premix) = (2,000,000 IU/ ton of ration)/(650,000 IU/g of source) =

***3.08 g of source per ton of ration (or per 10 pounds of premix)***

AB source required per ton of ration (10 lb of premix) = (10 g AB/ton ration)/(50 g/lb of source) =

***.2 lb of AB source/ton ration (or per 10 lb of premix)***

To make 500 lb of premix:

**(3.08 g vit A source/10 lb) \* 500 = 154 g of vit A source = 154 g \* 1 lb/454 g = *.34 lb of vit A source***

**(.2 lb AB source/10 lb) \* 500 = *10 lb of AB source***

***.34 lb vit A source + 10 lb AB source + 489.66 lb ground corn = 500 lb premix***

Example 3.

You are to feed a complete swine diet which should have 2.3 mg of Cu per pound of feed (NRC requirement). You are currently adding trace mineralized salt to the ration at a level of .5% and this salt has 300 mg of Cu per pound. You can use a source of copper sulfate which has 40% Cu if you need to fortify the trace mineralized salt so that the ration has enough Cu.

Step 1. How much Cu is required per 100 pounds of ration (per.5 lb of TM salt)? \*\*Note this problem can be similarly worked out on a per ton basis!

Step 2. How much Cu is already provided in the ration?

Step 3. How much is Cu deficient?

Step 4. What is the concentration of the Cu source?

Step 5. How much Cu source is required per 100 pounds of the ration (per .5 pound of TM salt)?

How much copper sulfate will you mix in 1000 pounds of your TM salt

**Problem 1.** Prepare a trace mineralized salt to be used at the rate of 10 pounds per ton on a complete diet for growing pigs (Table 7-2e; 50-80kg). Use iodized salt as the carrier. Use the following sources of trace minerals.

|  |  |  |  |
| --- | --- | --- | --- |
| Source | Atomic Wt | Formula Wt | Trace mineral percent |
| Mn SO4 | 54.94 (Mn) | 151.0 |  |
| CuSO4 | 63.54 (Cu) | 159.6 |  |

FeSO4.7H2O 55.85 (Fe) 278.0

ZnSO4 65.37 (Zn) 161.43

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Nutrient | Concentration in basal ingredients (1990 lbs/ton) | Amount of trace mineral in 1990 lbs basal ingredients | Required in a ton of feed | Deficiency |
| Mn | .5 mg/kg | mg | mg | mg |
| Cu | 1.4 mg/kg | mg | mg | mg |
| Fe | 35 mg/kg | mg | mg | mg |
| Zn | 45 mg/kg | mg | mg | mg |

|  |  |  |
| --- | --- | --- |
| Ingredient | Amount needed per 10 lbs of salt mix | Amount needed per ton of salt mix |
| Mn SO4 | Gram | Gram |
| CuSO4 | Gram | Gram |
| .  FeSO4 7H2O | Gram | Gram |
| ZnSO4 | Gram | Gram |
| Iodized salt | Pounds | Pounds |

1. Determine the concentration of the following vitamins or minerals in a **ton** of complete ration if the following premix is fed at 15 lbs/ton of complete ration.

|  |  |  |
| --- | --- | --- |
|  | **Premix Contains:** | **Ton of Ration Contains:** |
| Vit. A | 100,000 IU/lb | IU |
| Vit. D | 20,000 IU/lb | IU |
| Riboflavin | 50 mg/lb | mg |
| B12 | .75 mg/lb | mg |
| Fe | 1.5% | g |
| Zn | .115% | g |

1. A dry pregnant cow requires 0.1 mg of cobalt per kg diet. If a mineral mixture contains 2% cobalt, how much of the mineral mixture would you have to add per ton of feed to meet her requirements?

grams of mineral mixture per ton of feed

1. A beef cow requires 24,000 IU of vitamin A/ day. Her diet fed in dry lot (no grass available) is 26 pounds of grass hay (as fed, 88% DM) which contains 400 IU/pound of DM and 4 pounds of supplement, which, before a vitamin source is added does not contain any vitamin A. You have access to a vitamin source from the feed company that contains 1,000,000 IU of vitamin A per pound which you will add to the cow's supplement. Fill in the following blanks.

Vitamin A supplied by the hay consumed in 1 day IU

Deficiency of vitamin A: IU

Pounds of vitamin A source required to go into each day's supplement (4 pounds:

Pounds of vitamin A source to add to the supplement to mix a ton of supplement:

pounds of source/ton of supplement