Agronomy 354 Manure Worksheet

You are asked by a client to wisely manage the nutrients from a 1 X 10^6 caged layer (4-lb bird) operation in NC Iowa. (For calculations, if a range of values is given, use the midway point.)

a) An analysis indicates the manure contains 35+80+50 lbs/ton (N+P_2O_5+K_2O). From a reference source, 1000 birds are estimated to produce 10.5 tons/yr of manure. (These are realistic estimates taken from an older 2003 publication ISU PM 1811.)

b) Soil tests recommend 180 lbs N, 100 lbs P_2O_5, and 80 lbs K_2O per acre for corn production.

1) How many tons/acre of manure must be applied to meet the N requirement? (You must consider the 1st-yr availability and N volatilization factor--assume the manure is broadcast (solid) applied and not incorporated within 4 days.)

\[
\frac{35 \cdot 0.55 \cdot 0.80}{15.4 \text{ available N/}T} = \frac{180\text{ lbs}}{15.4 \text{ lb N/}T} = 11.69 \text{ T/acre}
\]

2) How many acres of corn can this manure be used to meet the N requirement at the rate calculated in question 1?

\[
\frac{10.5 \text{ T/1000 birds/yr}}{1,000,000 \text{ birds}} = \frac{10500 \text{ T}}{11.69 \text{ T/acre}} = 898 \text{ acres}
\]

3) How many tons/acre of manure must be applied to meet the P_2O_5 requirement?

\[
\frac{80 \cdot 0.95}{76 \text{ lb avail P}_2\text{O}_5/}T = \frac{100\text{ lbs}}{76 \text{ lb/}T} = 1.32 \text{ T/acre}
\]

4) How many acres of corn can this manure be used to meet the P_2O_5 requirement at the rate calculated in question 3?

\[
\frac{10500 \text{ T}}{1.32 \text{ T/acre}} = 7955 \text{ acres}
\]

5) How many tons/acre of manure must be applied to the K_2O requirement?

\[
\frac{50 \cdot 0.95}{47.5 \text{ lb avail K}_2\text{O/}T} = \frac{80\text{ lbs}}{47.5 \text{ lb/}T} = 1.68 \text{ T/acre}
\]

6) How many acres of corn can this manure be used to meet the K_2O requirement at the rate calculated in question 5?

\[
\frac{10500 \text{ T}}{1.68 \text{ T/acre}} = 6250 \text{ acres}
\]

7) If the nutrient contents of this manure are to be fully utilized (i.e., no over-fertilization), what is the minimum number of acres that would you advise your client to rent?

If apply on less than \( \frac{7955 \text{ acres}}{6250 \text{ acres}} \), are over-applying P_2O_5

8) How much in pounds of additional N 1270.260, P_2O_5 0, and/or K_2O 136.460 must be purchased for these acres in question 7?

\[
\frac{7955 \text{ N}}{7057 \text{ acres}} = \frac{180\text{ lbs N/}acres}{1270.260 \text{ lbs N}} = \frac{7955 \text{ N}}{1765} = \frac{6250 \text{ lbs}}{80 \text{ lbs K}_2\text{O/}acres} = \frac{136.460 \text{ lbs K}_2\text{O}}{136.460 \text{ lbs K}_2\text{O}}
\]