



A Seasonal Prediction Model of Manure Excretion for Lactating Cows in the High Plains



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How much manure a lactating herd produce?

Example 1

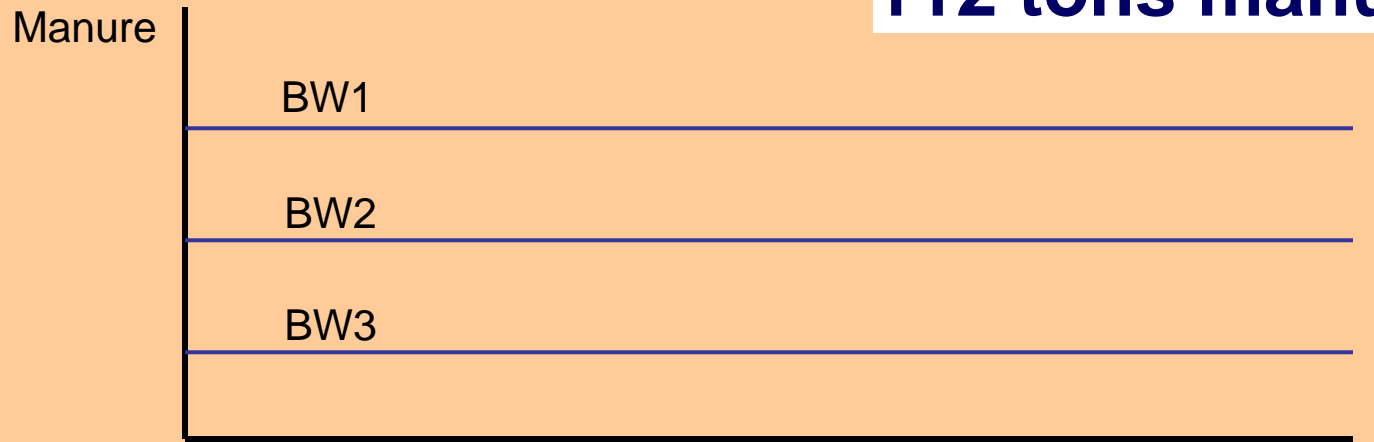
80 lbs/day/1000 lbs BW (AWMH)

1400 lbs BW

112 lbs manure/day

2000 cow-herd

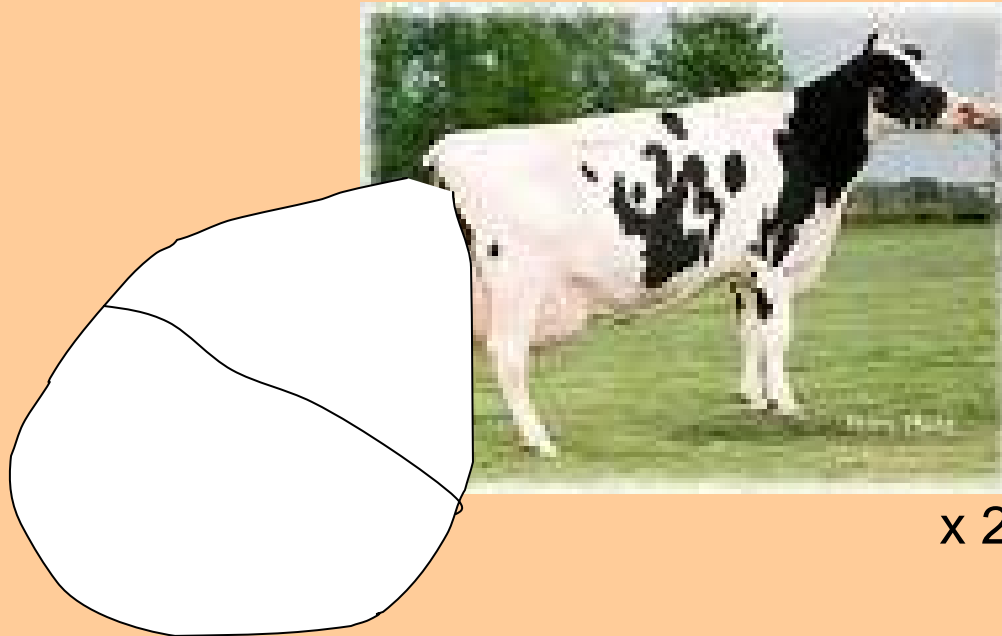
112 tons manure/day



TIME, DMI, RHA

How much manure a lactating herd produce?

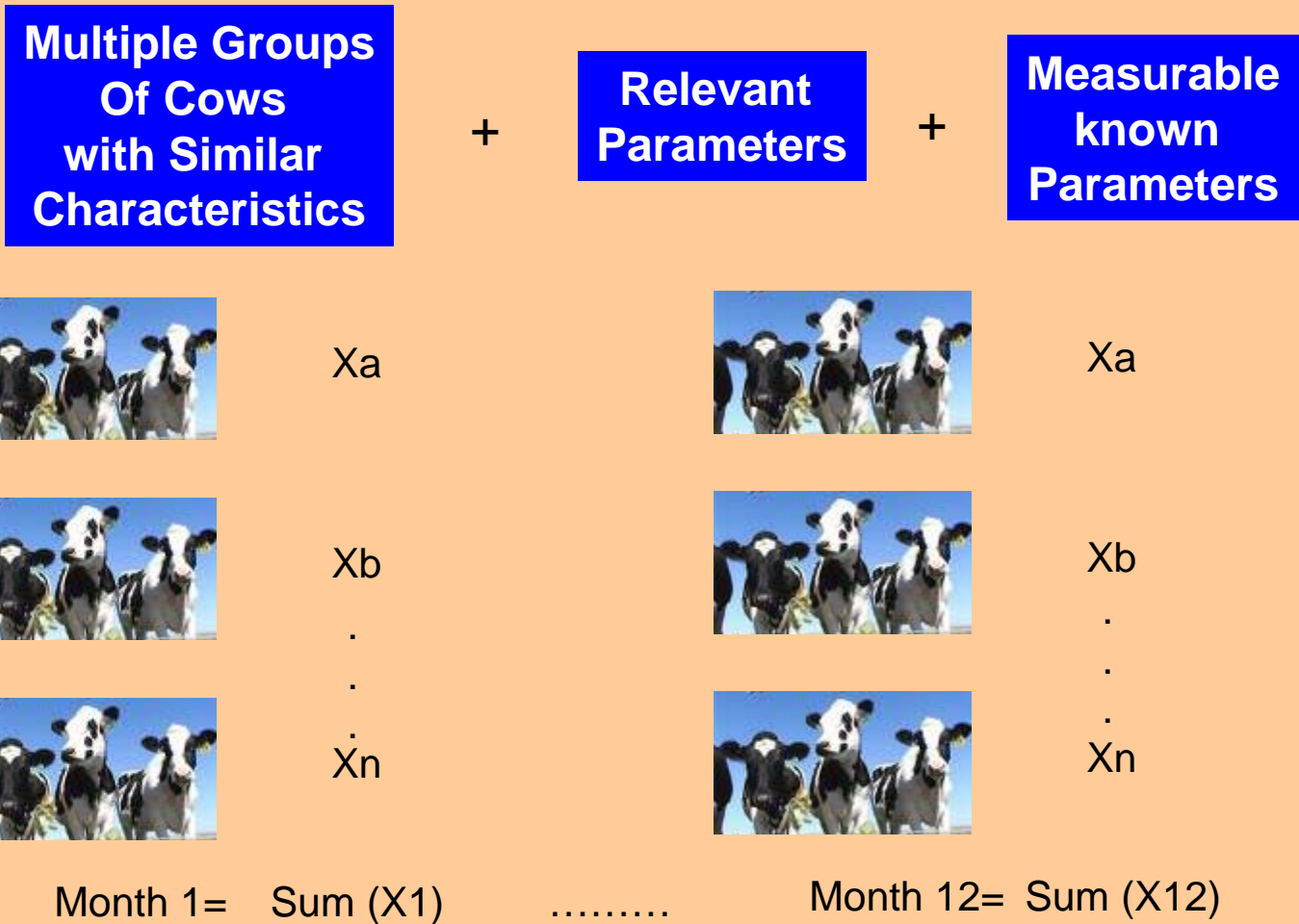
Example 2



x 2,000 cows x 365 days

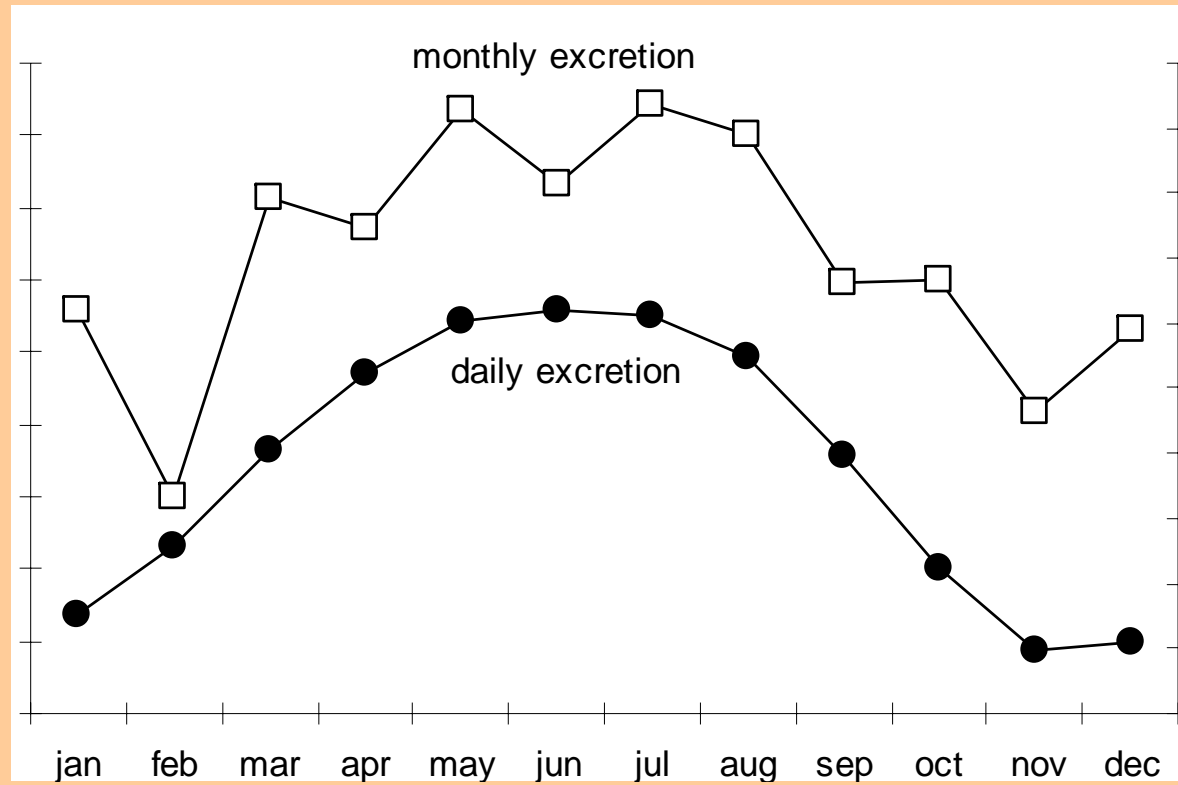
How much manure a lactating herd produce?

Example 3



How much manure a lactating herd produce?

Example 3



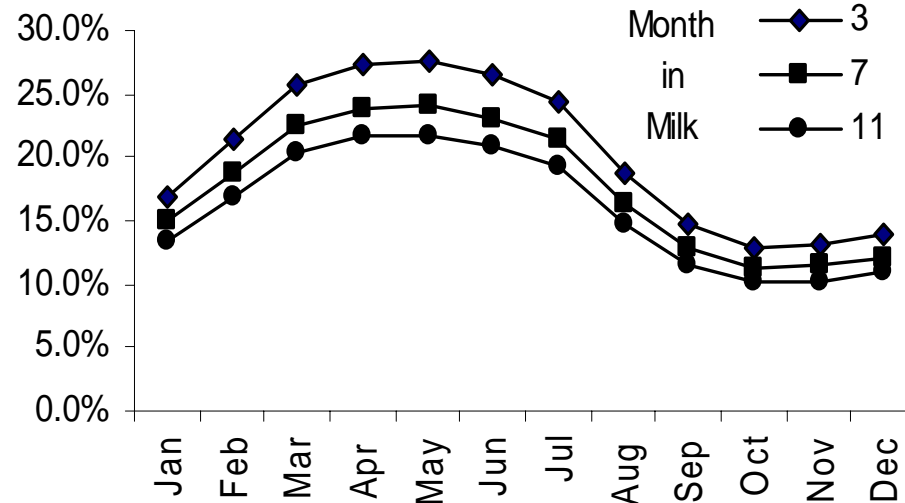
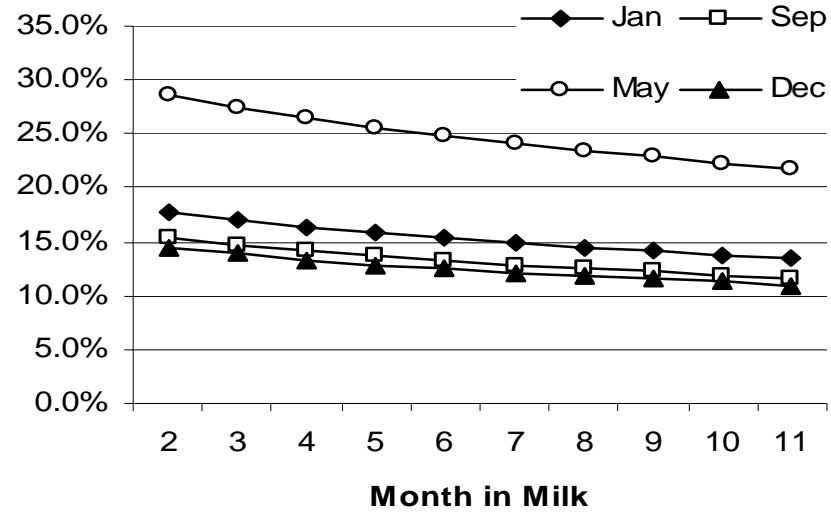
BUT, should not require tons of inputs!!!

Objective

To develop a stochastic dynamic model of herd performance with the purpose to predict seasonal manure excretion that match current state and national standards by adjusting and using better predictor parameters found in recent literature

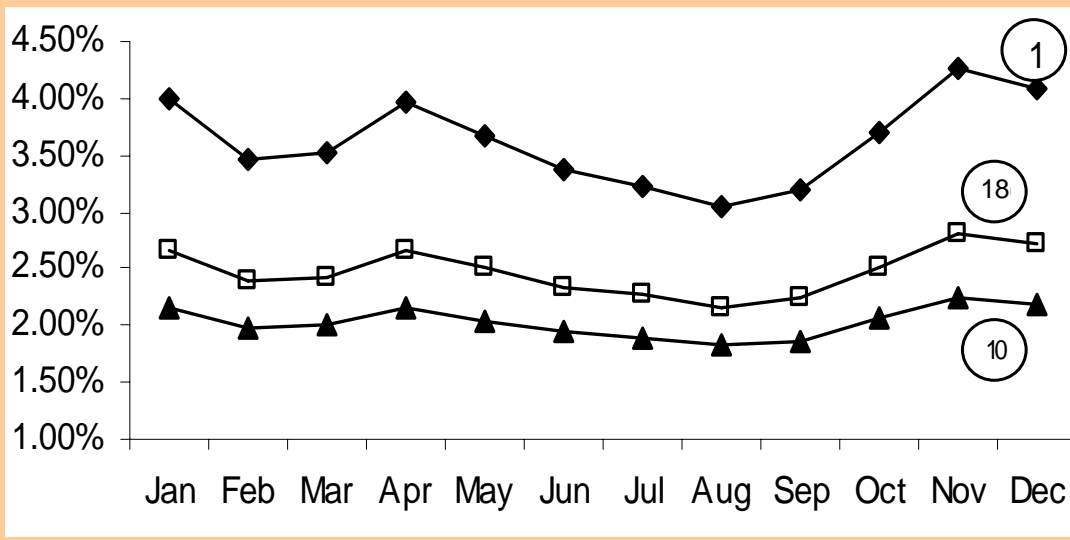
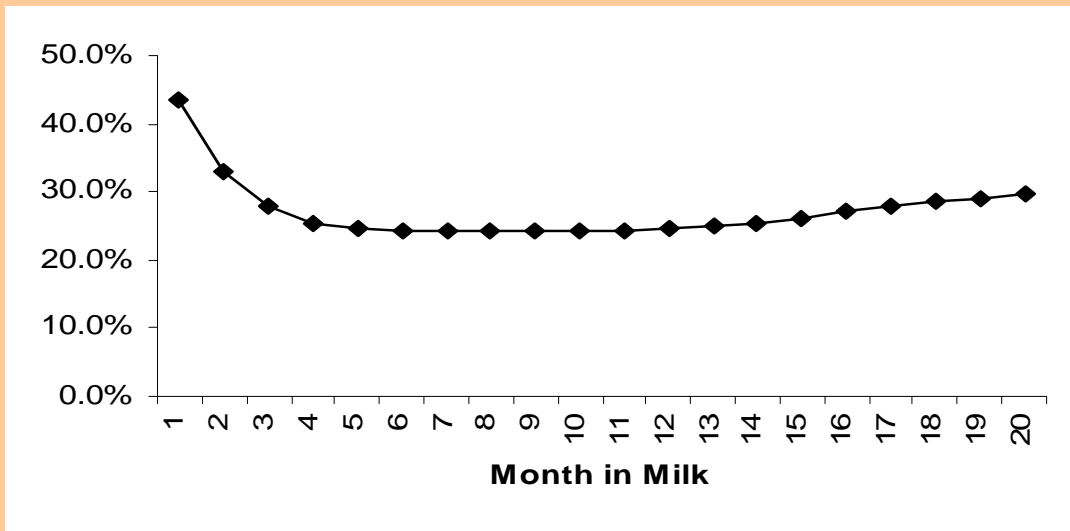
NM Herd Indexes (DHIA)

Pregnancy Rates

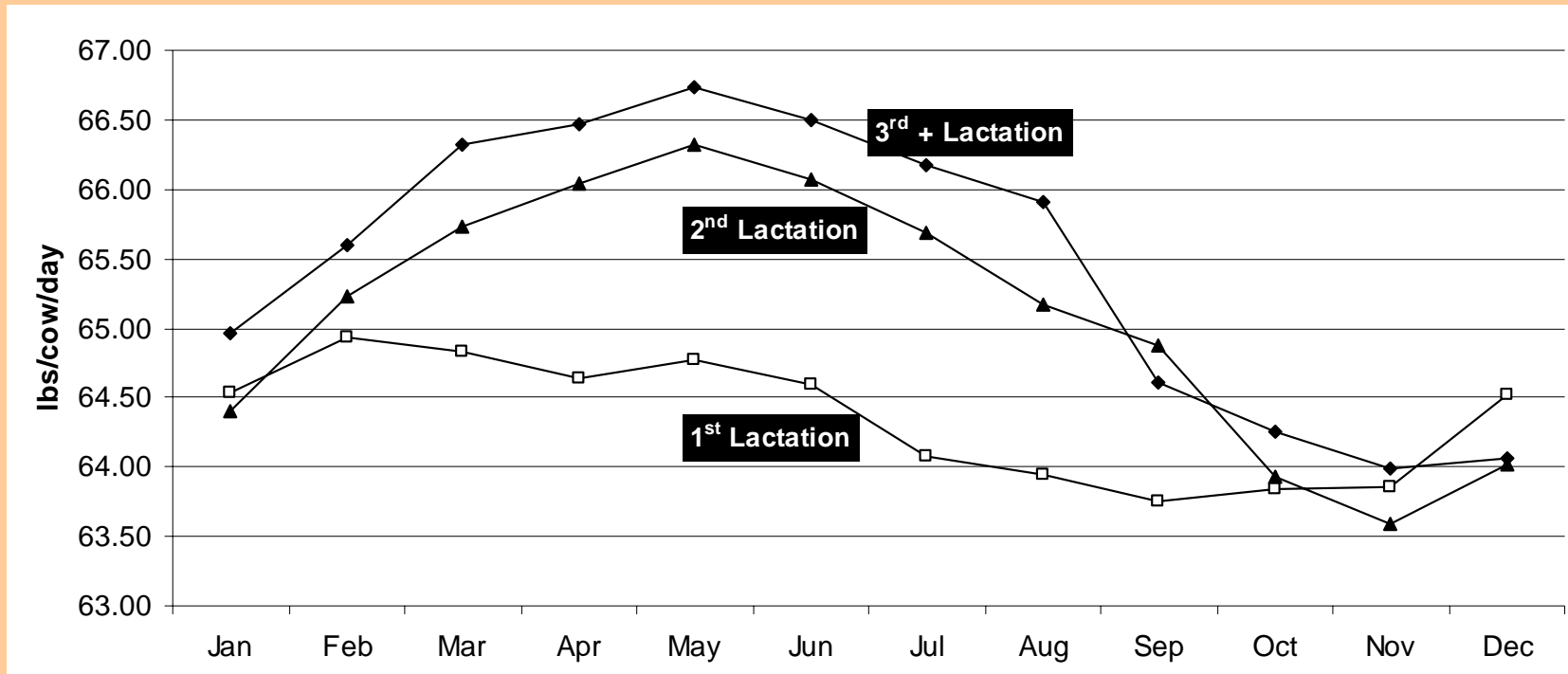


NM Herd Indexes (DHIA)

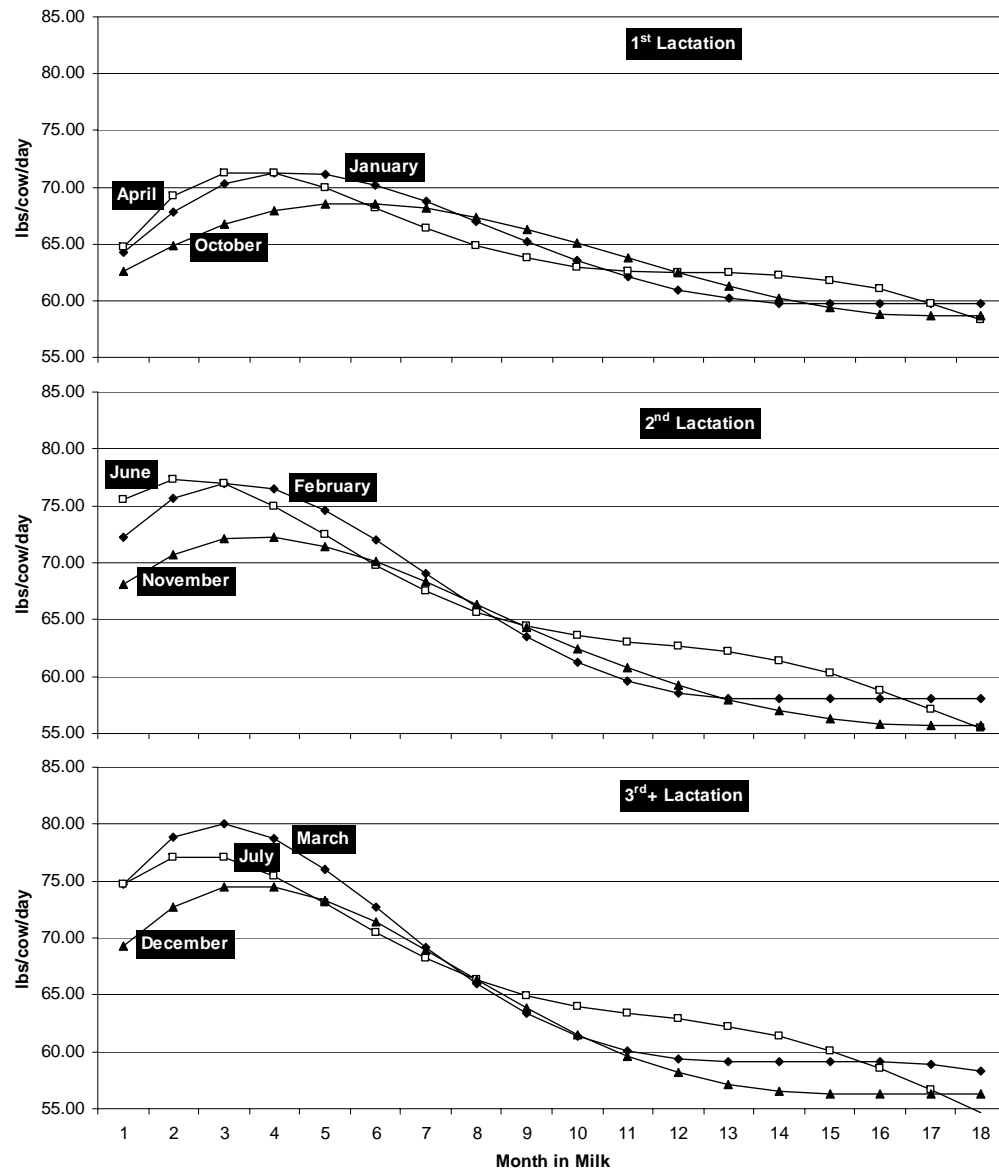
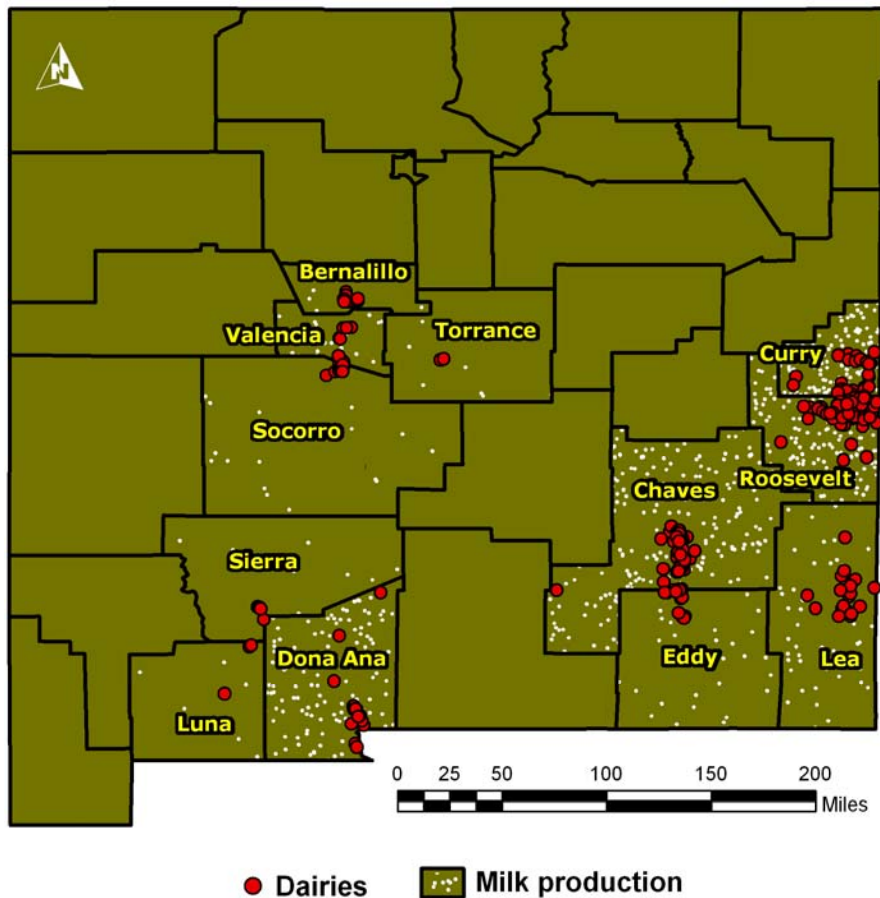
Culling Rates



Milk Productivity



Milk Productivity



The Model

$$MC_{l,i+1,j}=(MC_{l,i,j})(1-CU_{l,m,i}) \text{ for all } l \text{ and } j, m=\text{any month} \quad [1]$$

$$MC_{l,i+1,j+1}=(MC_{l,i,j})(PG_{l,m,i}) \text{ for all } l, i=2-12, m=\text{any month} \quad [2]$$

$$MC_{l,i+1,0}=(MC_{l,i,0})(1-PG_{l,m,i}) \text{ for all } l, m=\text{any month} \quad [3]$$

$$MILK_m = \sum_{l=1}^9 \sum_{i=1}^{18} \sum_{j=0}^7 (MC_{l,i,j})(MK_{l,m,i}) \text{ for } m=\text{any month} \quad [4]$$

l = lactation, i = month in milk, j = month of pregnancy, m = month of the year
 MC= Milking Cows, CU= Culling Rate, PG=Pregnancy Rate, MILK= Total Milk Production,
 MK= Cow Group Milk Production

Prediction of Manure Excretion

Nennich et al., 2005:

$$M_e = (MK) (0.616 \pm 0.057) + 101.76 \pm 5.07 \quad [5]$$

$$M_e = (MK) (0.72) + (1.45) (i) + 85.37 \quad [6]$$

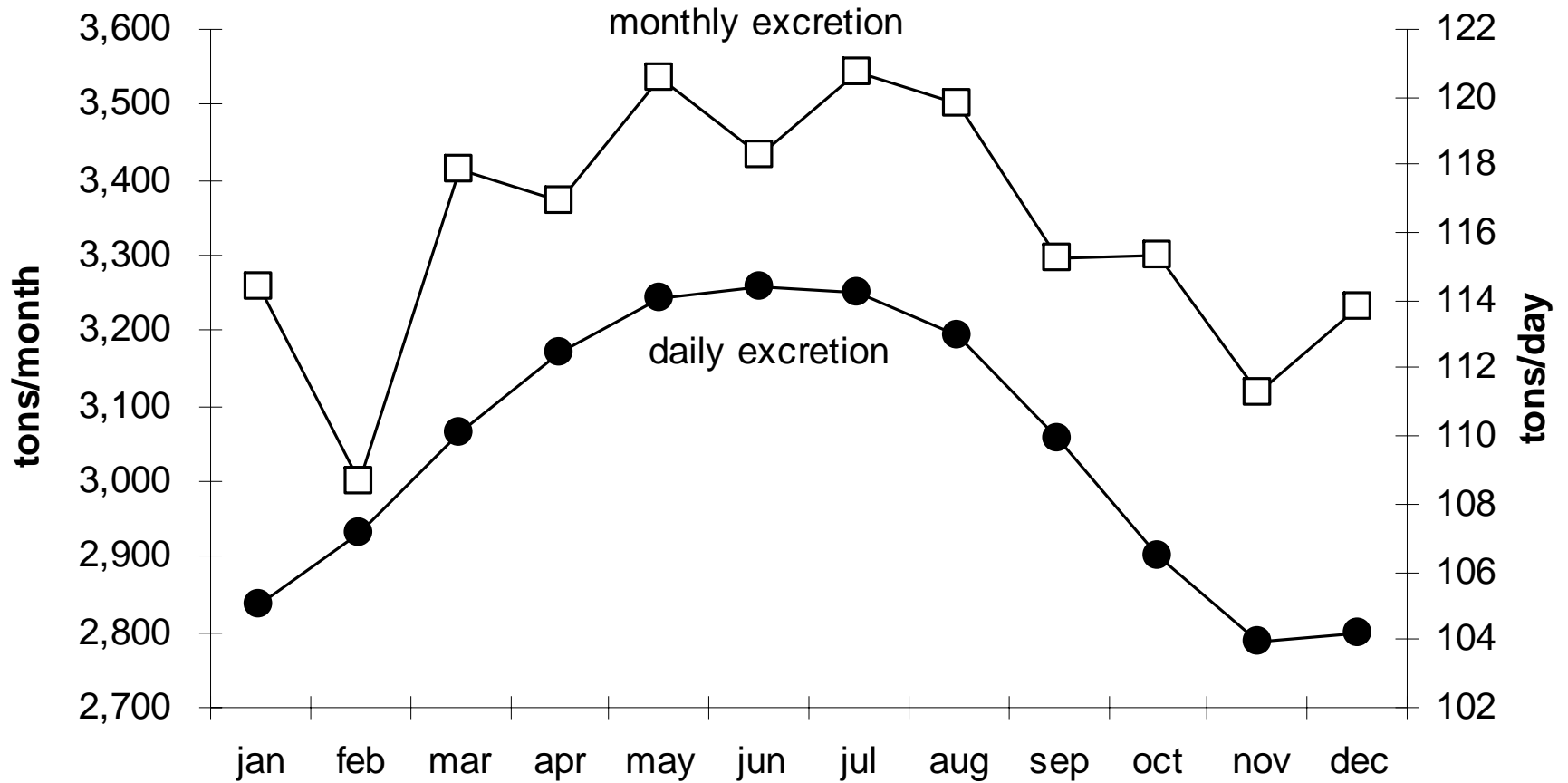
Adjustment:

$$M_e = (MK) (0.42) + (1.45) (i) + 85.37 \quad [7]$$

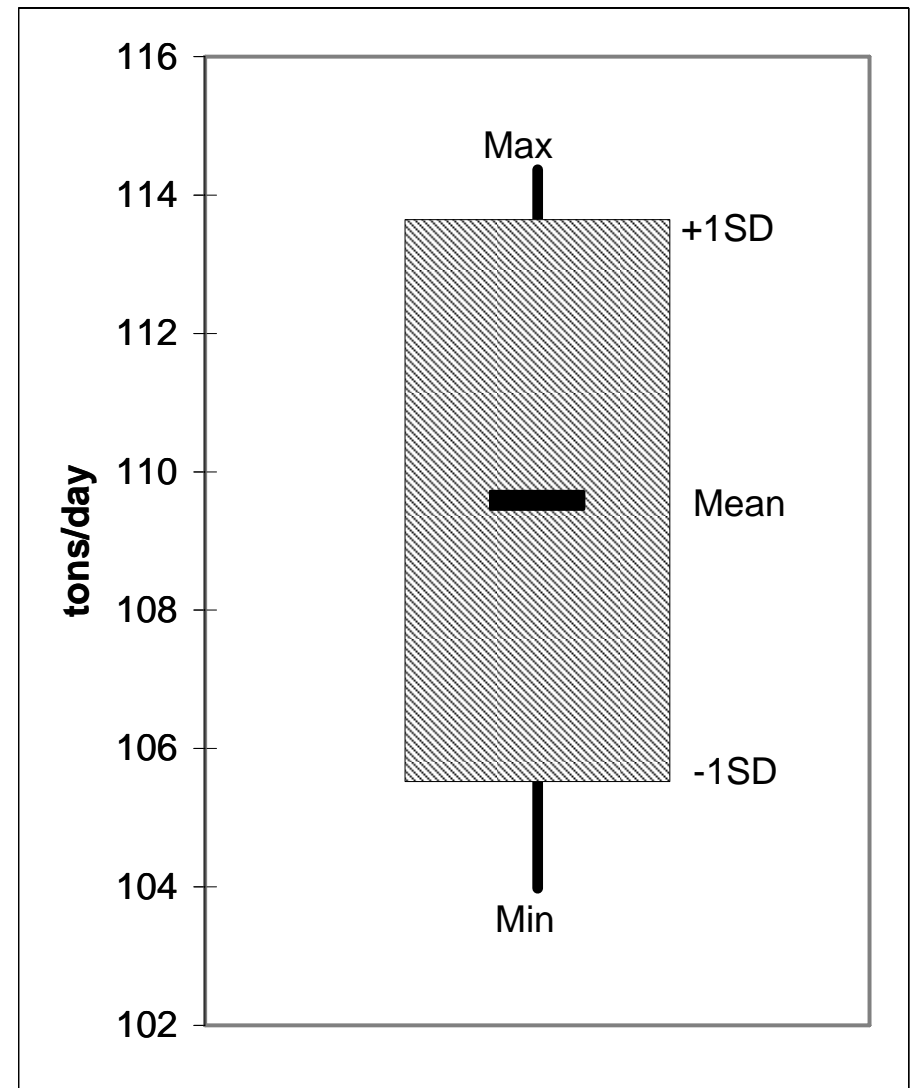
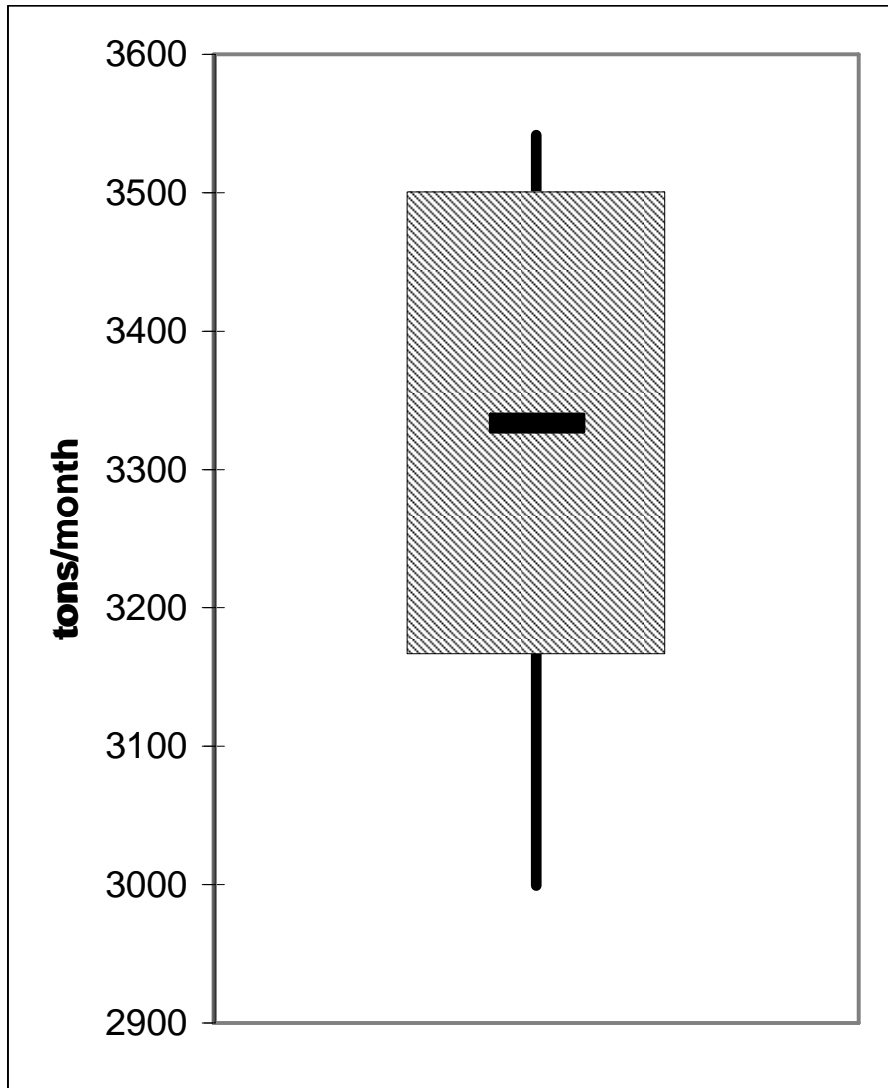
$$M_e = \sum_{l=1}^9 \sum_{i=1}^{18} \sum_{j=0}^7 (MC_{l,i,j}) (i * 1.45 + 0.42 * MK_{l,m,i} + 85.37) (DY_m) \quad [8]$$

M_e = Manure Excretion, DY_m = Days in month m

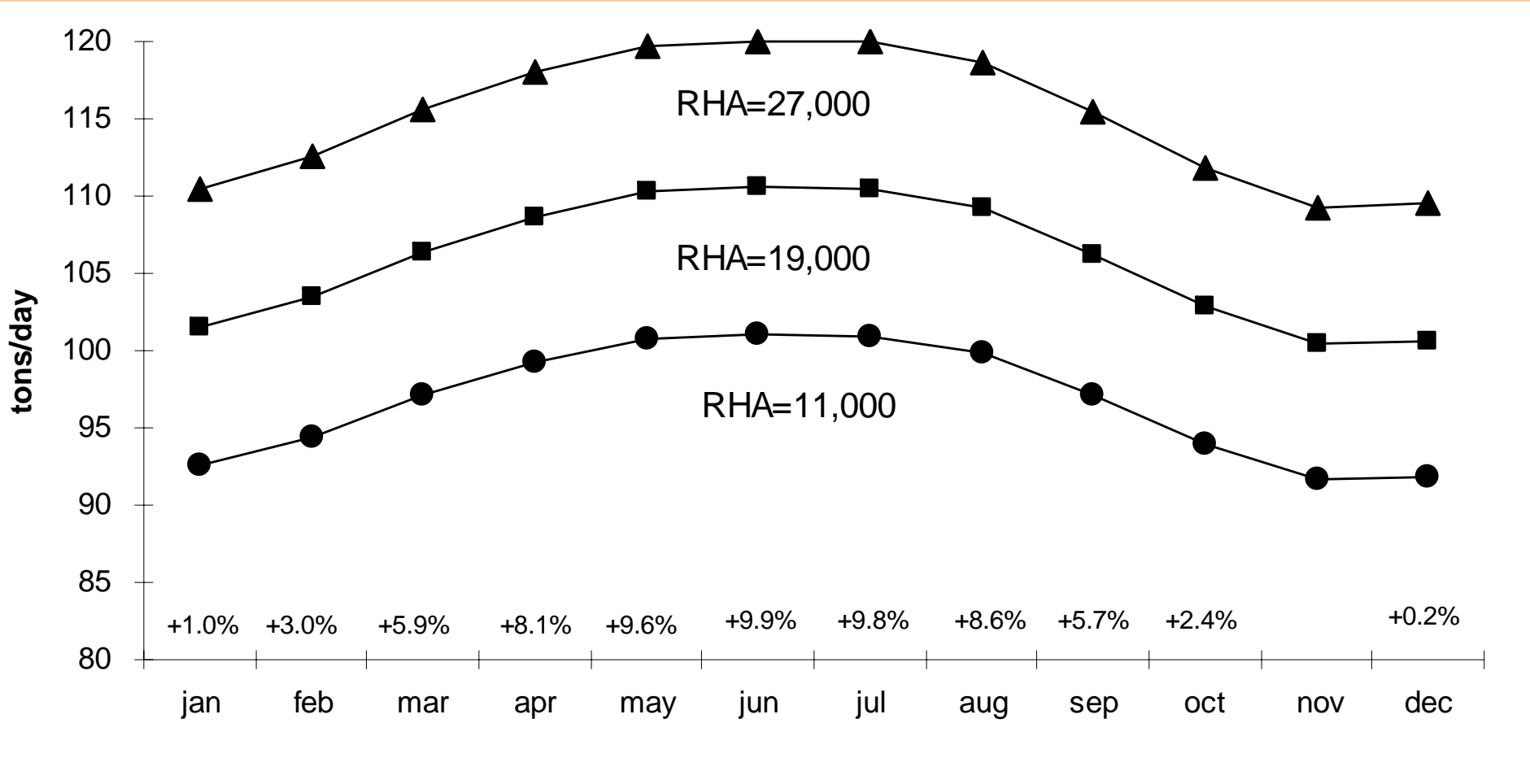
Results



Results



Results





Results

# Cows* (head)	Chaves	Roosevelt	Curry	Doña Ana	Lea	Eddy	Socorro	Others**	(tons) Total New Mexico
January	146,538	105,833	107,462	86,295	40,705	30,936	17,910	17,910	553,590
February	134,970	97,478	98,978	79,482	37,492	28,494	16,496	16,496	509,886
March	153,581	110,919	112,626	90,442	42,661	32,423	18,771	18,771	580,194
April	151,787	109,624	111,310	89,386	42,163	32,044	18,552	18,552	573,417
May	159,126	114,924	116,692	93,707	44,202	33,593	19,449	19,449	601,141
June	154,397	111,509	113,225	90,923	42,888	32,595	18,871	18,871	583,278
July	159,377	115,106	116,877	93,856	44,272	33,646	19,479	19,479	602,093
August	157,628	113,843	115,594	92,826	43,786	33,277	19,266	19,266	595,485
September	148,408	107,184	108,833	87,396	41,224	31,331	18,139	18,139	560,653
October	148,536	107,276	108,926	87,471	41,260	31,358	18,154	18,154	561,135
November	140,374	101,381	102,941	82,665	38,993	29,635	17,157	17,157	530,302
December	145,371	104,990	106,606	85,607	40,381	30,689	17,768	17,768	549,180
Total (year)	1,800,094	1,300,068	1,320,069	1,060,055	500,026	380,020	220,011	220,011	6,800,354

Conclusions

- **Development of seasonal manure excretion model is a substantial contribution to current prediction standards and sets up a baseline for continuing simulation work**
- **Some assumptions used in this approach could and should be reviewed along with scientific developments and availability of data. The core framework and the modeling structure, however, will remain valid**
- **The model has been integrated with the application Pond Size version 2.6 of the NM-NRCS**
- **The model is a user-friendly application developed in Visual Basic and Excel and is publicly available at <http://dairy.nmsu.edu> ...Tools**

Questions?

Comments?



Feedback?



Suggestions?

Thank you very much

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