Using Box Time indicators to rank cows according to their efficiency in Robotic Milking Systems

Liliana Fadul[1], Roger Cue[2], Gervais Bisson[1], Robert Moore[1] and René Lacroix[1]

[1]Lactanet, Sainte-Anne-de-Bellevue, Quebec, Canada

[2] McGill University, Sainte-Anne-de-Bellevue, Quebec, Canada

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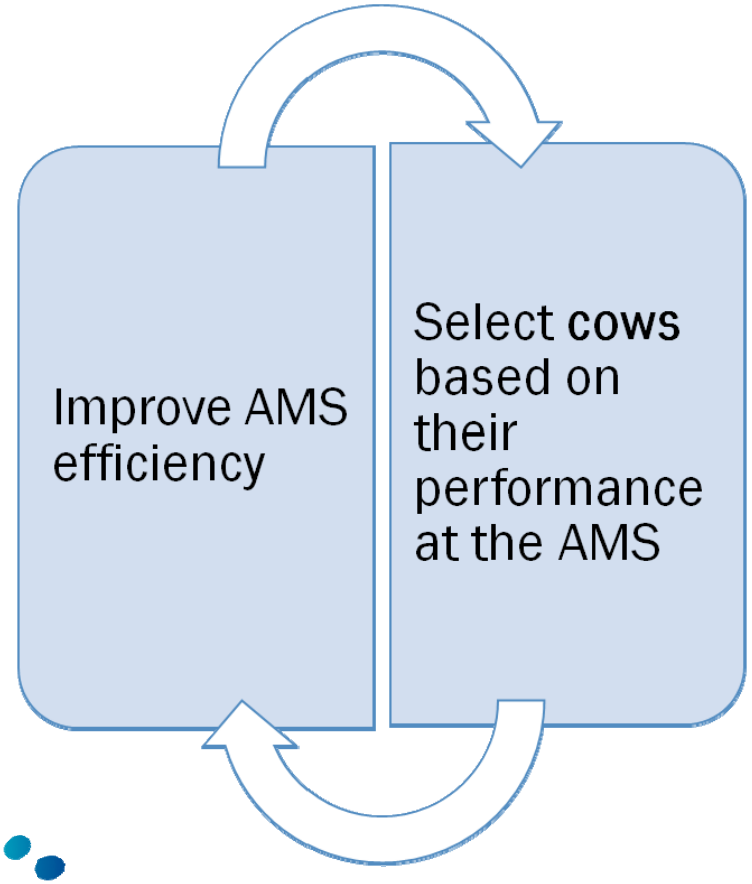
Context

- ✓Large amounts of data are generated by the Robotic Milking Systems (RMS) also known as AMS
- ✓Opportunity to add-value to these data by developing tools that can help improve decision making and AMS management

Context



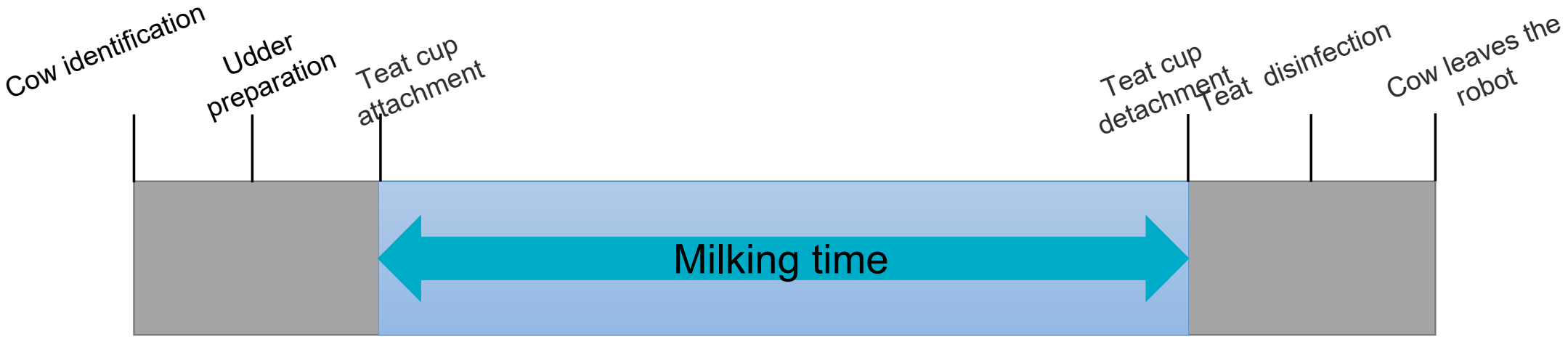
AMS Efficiency:
Milk yield/minute of box time

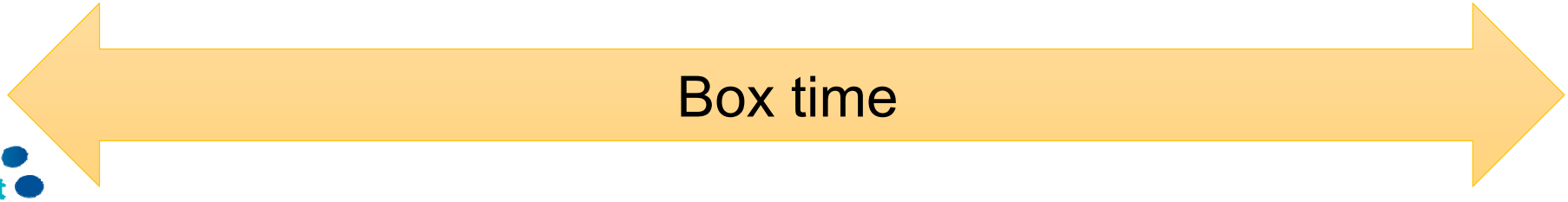
Decision support system for individual performance

- ✓ Optimum balance between milking speed and udder health
- ✓ Opportunity to work on functional traits (e.g., milkability)

(Gäde et al., 2007 and Vosman et al., 2014)

Box Time





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Box time – <u>milking time</u> = treatment time

Objective

Develop box time based indicators to **rank** and **select** the cows according to their performance at the AMS.

- Decision support system for individual performance

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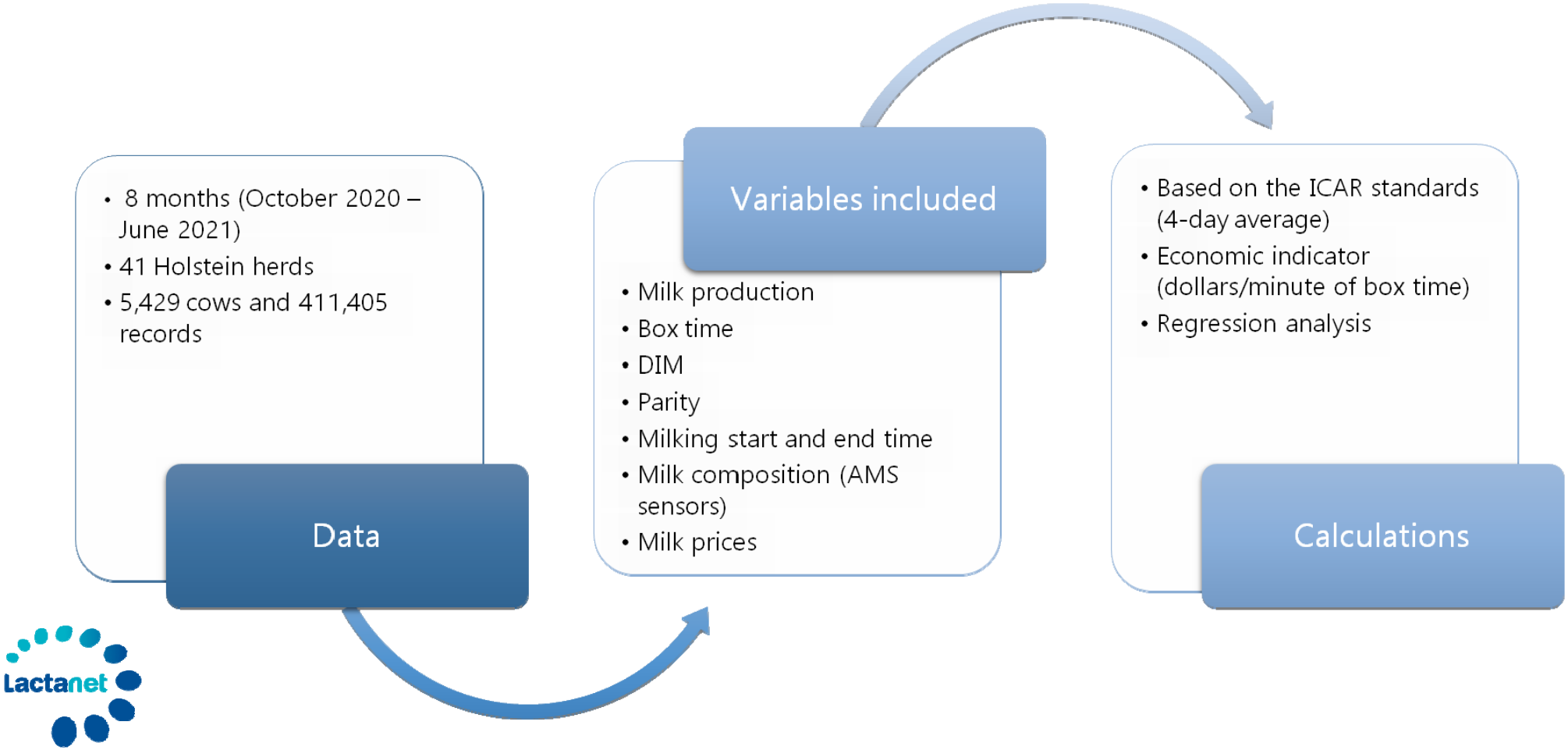
Data



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Calculations

Based on 96 hours (4-d avg)

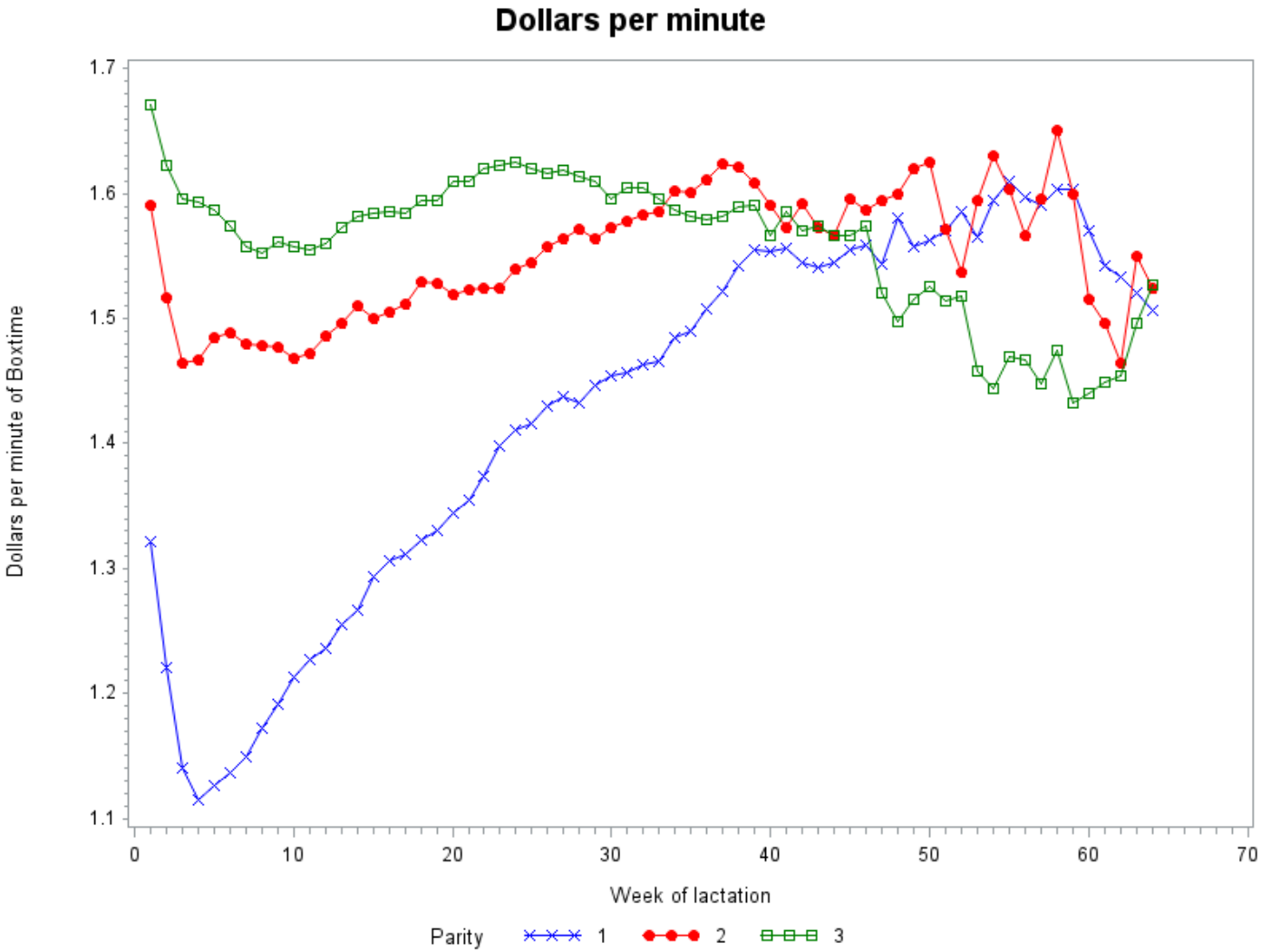
AMS efficiency/cow : Average of milk produced (kg) per minute of box time for a 96h period.

milk yield (kg) /box time (min)

Dollar/ minute of box time: Dollar value of milk produced per minute of box time for a 96h period.

income/box time

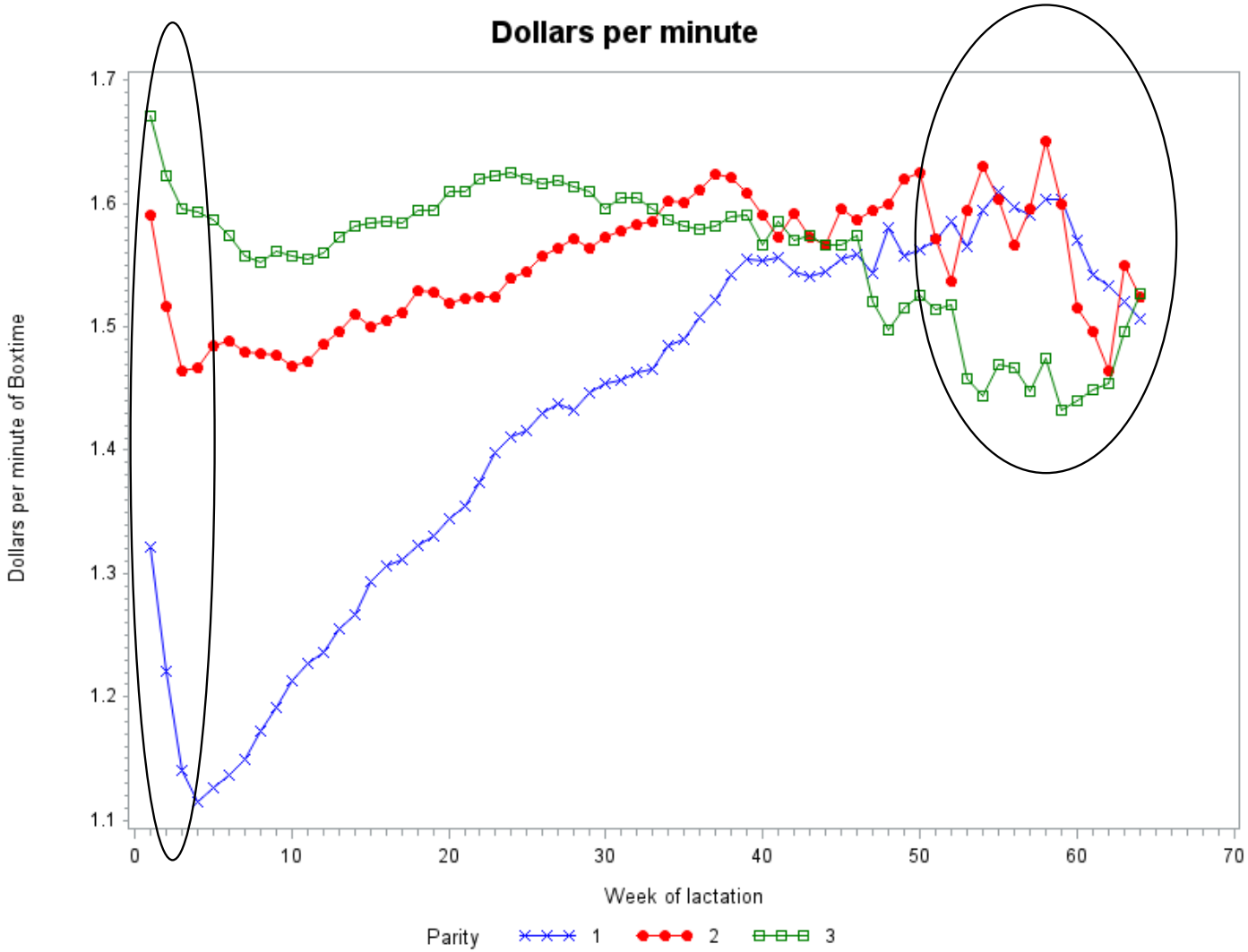
Income: a linear combination of milk components yield- a constant was used for lactose content.



Preliminary analysis has shown that box time varies across and within lactations

Affected by DIM

Heringstad and Bugten, 2014



Preliminary analysis has shown that box time varies across and within lactation

Affected by DIM

Heringstad and Bugten, 2014

DIM were limited to 28 and 365

Adjustments factors were calculated

Regression Analysis

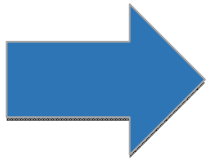
Regression analysis was performed to generate factors to correct indicators for:

Parity groups (1, 2 and +3)

Stage of lactation (DIM)

Herd was considered as a random effect

Best fittings were obtained with quadratic polynomials



The equations generated a factor to correct the data:

To 150 DIM within each parity

To adjust to parity 2 for data in the other two parity groups.

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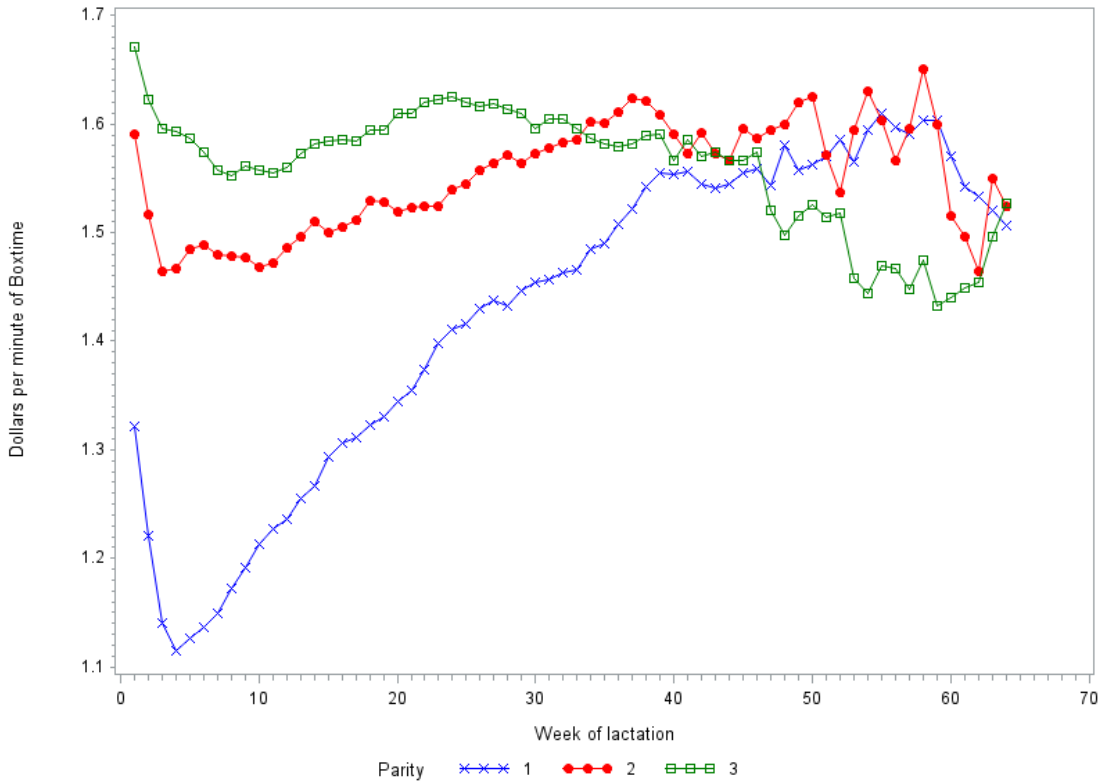
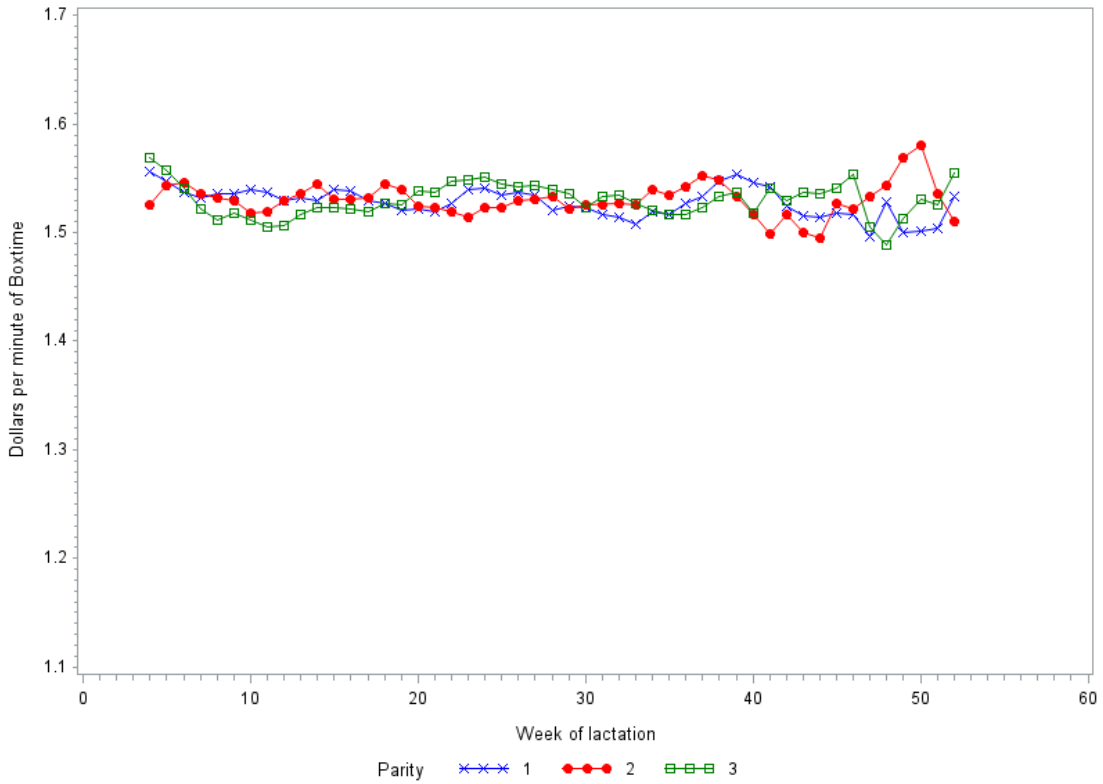
Dollars per minute



Dollars per minute



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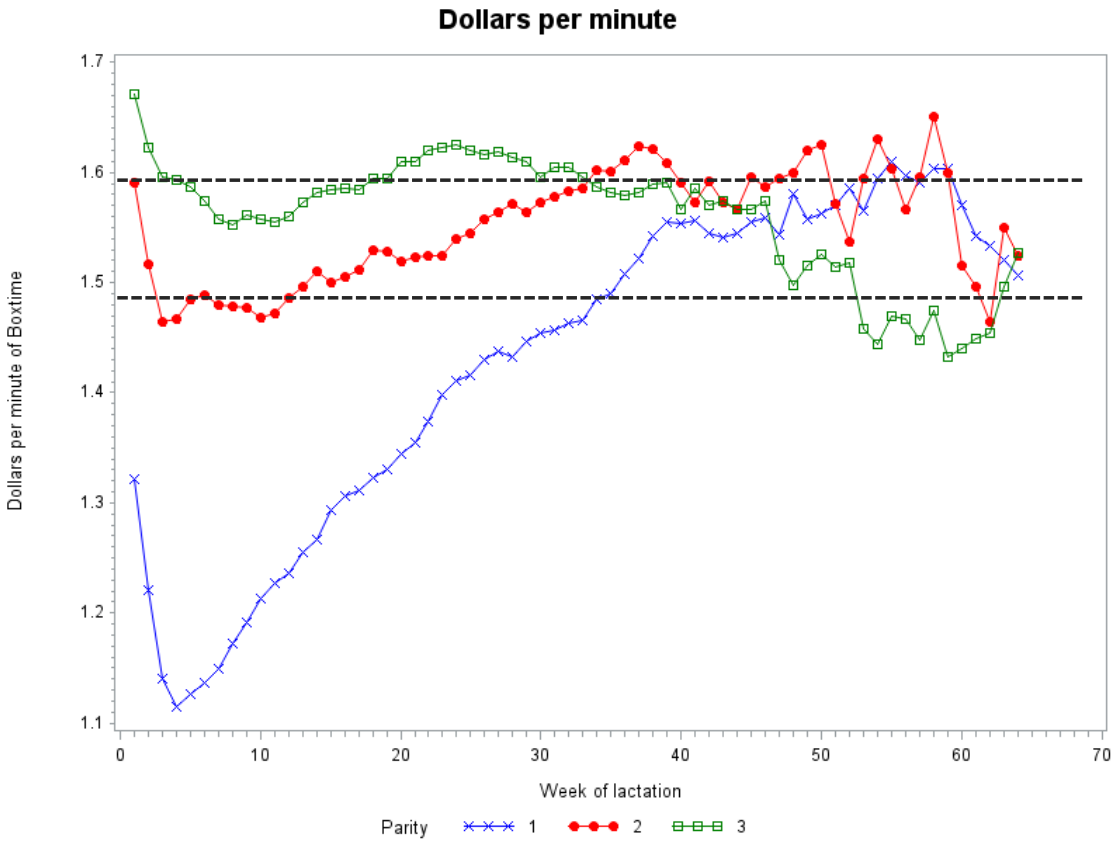
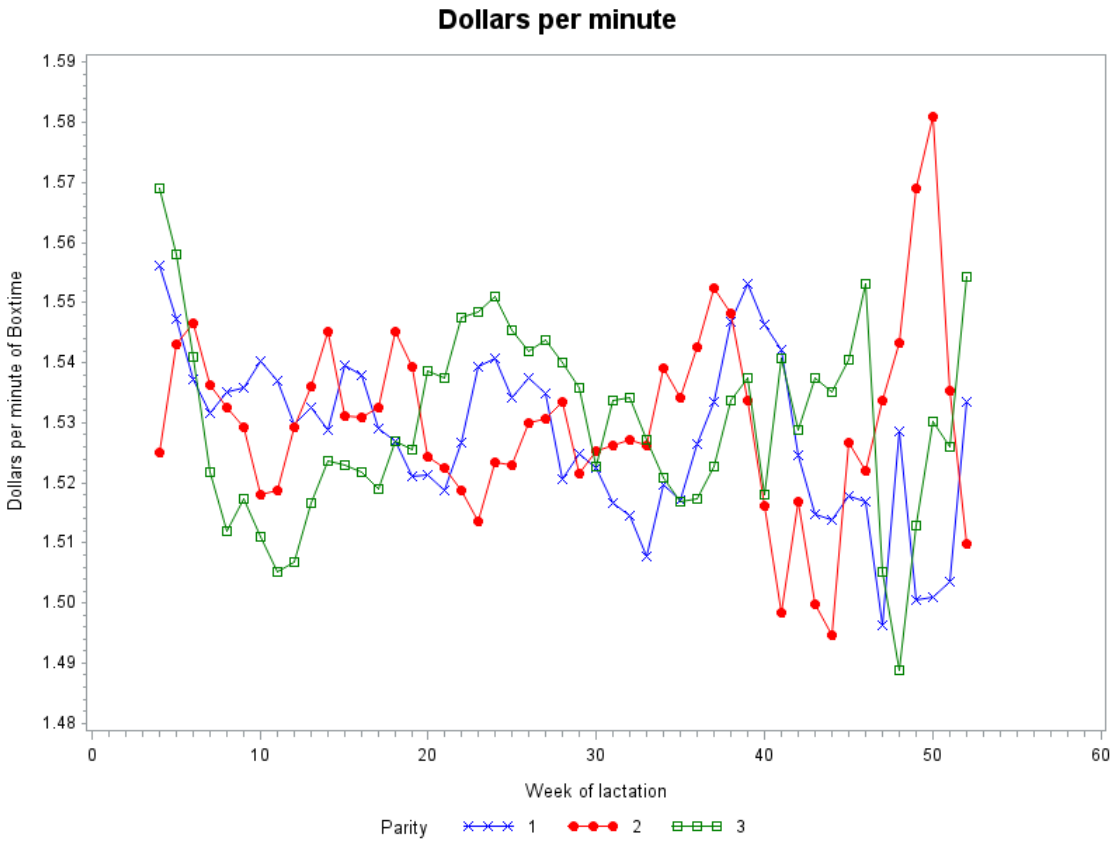

Dollars per minute
Dollars per minute of Boxtime
1.7
1.6
1.5
1.4
1.3
1.2
1.1
0
10
20
30
40
50
60
70
Week of lactation
Parity
1
2
3


Dollars per minute
Dollars per minute of Boxtime
1.59
1.58
1.57
1.56
1.55
1.54
1.53
1.52
1.51
1.50
1.49
1.48
0
10
20
30
40
50
60
Week of lactation
Parity
1
2
3

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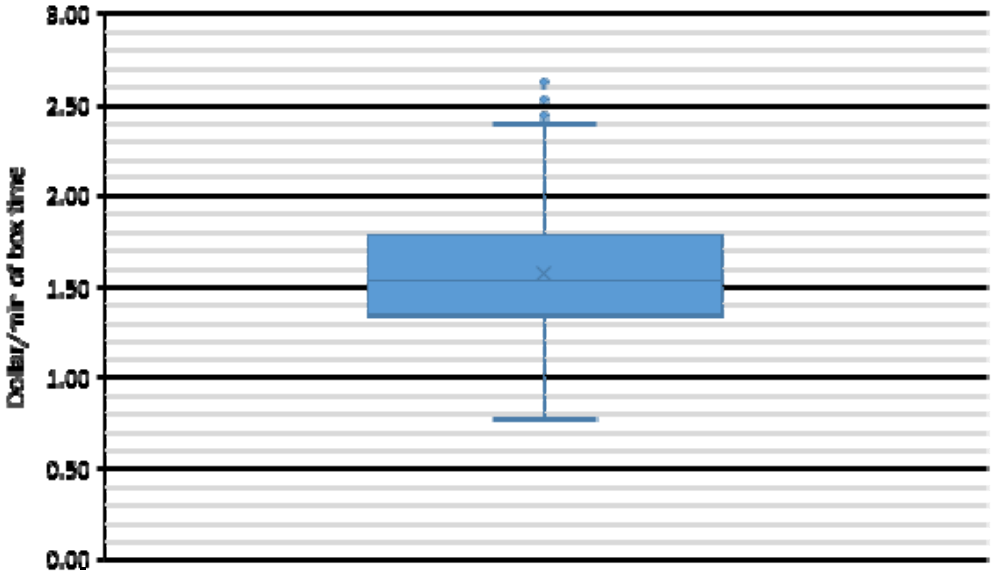
Dollar per Minute of Box Time

Cow	Parity	DIM	Dollar/min of box time	Adjusted dollar / min of box time
A	1	62	$ 1.01	$1.32
B	1	264	$ 1.25	$1.37
C	5	41	$1.27	$1.35

Dollar per Minute of Box Time



Trait	Mean
Box time (min)	7.22
Dollar/min box time	1.50
Milk (kg)/min box time	1.86

Herd Report

Robot - Production and Efficiency

Name	Herd Number	Service	Test Date
John DOE John DOE	**QC 99999**	**Alternate**	**Mar 5, 2020**

List | Graph | User Guide

○ Key Indicators - Herd ◉ Key Indicators - Robot (7 days)

Key Indicators - Robot (7 days)	Results	12 months	Robot prov. avg.	Top 20%-robot
Milk/robot (kg)	2124	2039	1631	2086
Fat/robot (kg)	84.7	79.7	65.3	83.3
Milk/cow/day (kg)	36.7	37.8	34.3	37.7
Fat/cow/day (kg)	1.46	1.48	1.37	1.50
Number of cows/robot	58	54	48	56
Number of milkings/robot	168	155	131	154
Number of milkings/cow	2.90	2.86	2.76	2.78
Average milk/milking (kg)	12.6	13.2	12.5	13.6
Number of refusals/cow	2.1	2.3	2.1	1.6
Number of failures/robot	1.9	3.2	5.2 (1)	4.3
Robot free time (%)	7.6	15.6	27.7	17.9
Average time/milking (min) *	7.23	7.10	7.15	6.88
Efficiency (kg milk/min robot) *	1.75	1.85	1.75	1.97
Estimated max milk/robot (kg) *	2064	2189	2072	2323
Estimated max fat/robot (kg) *	82.3	85.6	83.0	93.1
Milk value/cow ($)	24.21	8197	7663	8416
Milk value/robot ($)	1594	1558	1259	1593

** Calculated value*

Cow Report

AMS efficiency
Milk yield (kg)/minute of box time

Dollar per minute of box time ($)

Vaches Individuelles

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Sélectionnez l'indicateur supplémentaire:

- [ ] Efficacité (kg lait/min robot)%
- [ ] Efficacité tr. réussis
- [ ] Efficacité Ajustée
- [ ] Valeur du lait/min robot ($)
- [ ] Val rel vitesses de traite (%)
- [ ] Gras/min robot (kg/min)
- [ ] Valeur du gras/min robot ($)
- [ ] Val rel valeur gras/min robot (%)

Tout sélectionner Tout désélectionner

Sélectionnez le numéro de lactation

- [ ] 1
- [ ] 2
- [ ] 3+

Tout sélectionner Tout désélectionner

Sélectionnez la date de test :

9 avr. 22

Rafraîchir

No. Cou	Date	Lactation	Jours en Lait	Efficacité (kg lait/min robot)	Valeur du lait ajusté/min robot($)	Val.rel. de valeur du lait ajusté/min robot (%)	Temps dans robot/jour mm:ss	Temps dans robot/visite mm:ss	Temps de préparation mm:ss	Vitesse de traite (kg/min)	Prod moy/jour moy(kg)	Nb de traites moy/jour	Test de gras (kg/hl)	Test de protéine (kg/hl)
Moyenne			181	1,58	1,33 $	100 %	23:34	7:10	2:50	2,77	36,54	3,30	4,57	3,06
2831	9 avr. 22	4	184	1,19	0,90 $	68 %	34:04	8:30	2:55	1,81	40,6	4,0	4,50	3,01
9758	9 avr. 22	4	141	1,25	0,92 $	69 %	35:10	9:04	3:46	2,14	44,0	3,9	4,20	2,85
1402	9 avr. 22	1	245	1,29	0,98 $	74 %	18:09	6:34	3:03	2,42	23,4	2,8	4,07	2,52
4655	9 avr. 22	5	49	1,42	1,01 $	76 %	29:48	8:33	2:33	2,03	42,4	3,5	3,55	3,00
3795	9 avr. 22	3	121	1,30	1,03 $	77 %	26:44	8:41	2:32	1,84	34,7	3,1	4,45	3,22
9311	9 avr. 22	2	251	1,42	1,04 $	78 %	23:40	7:01	3:17	2,67	33,6	3,4	4,14	2,93
1394	9 avr. 22	1	229	1,11	1,06 $	80 %	26:52	7:53	3:25	1,96	29,9	3,4	5,28	3,05
3781	9 avr. 22	3	203	1,72	1,49 $	113 %	21:53	6:12	2:46	3,12	37,7	3,5	5,69	2,62
28082	9 avr. 22	4	236	2,05	1,50 $	113 %	19:36	5:27	2:45	4,15	40,2	3,6	4,32	2,67
1400	9 avr. 22	1	309	1,72	1,50 $	113 %	16:09	5:08	2:55	3,97	27,8	3,1	5,03	3,23
8876	9 avr. 22	1	49	1,64	1,53 $	116 %	28:16	7:52	2:36	2,46	46,5	3,6	3,51	2,82
5166	9 avr. 22	1	58	1,56	1,54 $	116 %	23:38	8:26	2:39	2,28	36,9	2,8	3,89	3,04
7234	9 avr. 22	4	187	1,90	1,57 $	118 %	22:38	5:15	3:03	4,53	43,1	4,3	4,98	2,95
5165	9 avr. 22	1	72	1,79	1,62 $	122 %	25:56	9:41	2:53	2,54	46,3	2,7	3,58	3,10
9710	9 avr. 22	1	184	1,90	1,67 $	126 %	16:08	4:32	2:34	4,40	30,8	3,6	4,54	3,00
5148	9 avr. 22	1	92	1,48	1,69 $	127 %	17:41	5:23	2:41	2,96	26,1	3,3	5,51	3,37
5156	9 avr. 22	1	65	1,80	1,70 $	128 %	19:36	7:22	2:43	2,84	35,2	2,7	4,02	2,85
9510	9 avr. 22	1	274	2,02	1,75 $	132 %	14:29	4:43	2:39	4,62	29,3	3,1	4,74	3,28
5708	9 avr. 22	1	45	1,76	1,78 $	134 %	19:23	7:13	2:40	2,80	34,2	2,7	4,03	3,20
9131	9 avr. 22	4	191	2,46	2,10 $	158 %	12:54	4:58	2:26	4,85	31,8	2,6	5,02	3,15

Implications and Future Developments

Can be used to rank and select cows according to their performance at the AMS

To calculate benchmarks for comparative analysis across AMS herds, as the AMS efficiency is key for the economical success of the farms.

Adjustments for other breeds

Possibility of developing or including genetic tools

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Scan the code and read more about the box time project

This project was funded by

Liliana Fadul
Innovation & Development
lfadul@lactanet.ca