Comparison of effects of four weaning methods on health and performance of beef calves

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Animal; supplemental materials

Supplemental Material S1: SAS code

Both locations, all calves for full study period
The first code was done simply as a survey of the full study, including all calves at all times. Diagnostics were included (s residual influence (iter=5 effect=ID est) to examine for the influence of individual calves on the model.
Note that “weight1” and “date1” were initial values used for blocking and assignment to treatment. Weight2 was used as “entry weight” for the trial. The GROUP = command allows for unstructured estimates of variance for each level of a grouping (in most cases, source or location). See section 9.6.2 in Littell RC, Milliken GA, et al., “SAS for Mixed Models,” 2nd Ed.)

```
proc mixed data = agron3.allstep1;
title 'all calves Time*time interactions no outpred';
class source ID trtmt sex;
model wts= source|time|trtmt time*time time*time|source time*time|source|trtmt sex
   base / ddfm = kr solution s 
   residual 
   influence (iter=5 effect=ID est);
random int time / type =un sub = ID group = source;
run;
proc mixed data = agron3.allstep1;
title 'all calves time*time interactions with outpred';
class source ID trtmt dummy sex;
model wts= source|time|trtmt time*time time*time|source time*time|source|trtmt sex
   base / ddfm = kr solution outpred = agron4.alltimequad;
random int time / type =un sub = ID group = source;
run;
proc sort data= agron3.AlltimeQuad;
by ID;
data agron4.predgain ; set agron4.AlltimeQuad;
keep ID source sex trtmt base time wts pred pwt1 pwt2 pwt3 pwt4 pwt5 pwt6 date1
date2 date3 date4 date5 date6 date7 date8;
by ID;
if first.ID then do;
pwt1 = . ;
pwt2 = . ;
pwt3 = . ;
pwt4 = . ;
pwt5 = . ;
pwt6 = . ;
end;
if time = -2 then do;
pwt1=pred;
end;
if time = -1 then do;
pwt2=pred;
end;
```
if time = 0 then do;
pwt3=pred;
end;
if time = 1 then do;
pwt4=pred;
end;
if time = 2 then do;
pwt5=pred;
end;
if time = 3 then do;
pwt6=pred;
end;
if last.ID then output;

retain ID pwt1-pwt6;
run;
data agron4.AllGainquad; set agron4.Predgain ;
PredGain = pwt6 - pwt1;
predADG = Predgain/(date8 - date3) ;
run;
proc glm data = agron4.AllgainQuad;
class trtmt;
model predGain = trtmt;
lsmeans trtmt / adjust = tukey;
title ' All calves predicted gains full study compare trtmts';
run;
proc mixed data = agron4.AllgainQuad;
class trtmt;
model predGain = trtmt;
lsmeans trtmt / adjust = tukey;
run;
proc glm data = agron4.AllgainQuad;
class trtmt;
model predADG = trtmt;
lsmeans trtmt / adjust = tukey;
title ' All calves predicted ADG full compare trtmts';
run;
proc mixed data = agron4.AllgainQuad;
class trtmt;
model predADG = trtmt;
lsmeans trtmt / adjust = tukey;
run;

Both locations, all calves from D-13 to D0 and -13 to D7
The code below was used as first assessment. Results showed multiple interactions with source location, so separate analyses were run for the two locations (see below).

data agron4.temp ; set agron3.allkg;
keep source ID trtmt sex staygo base date3 date4 date5 date6 kg3 kg4 kg5 kg6 ;
data agron4.allToD7; set agron4.temp;
array kgs{4} Kg;:
do i=1 to 4 ;
time = (i-4) +1 ;
wts = kgs{i};
output;
end;
run;
proc mixed data = agron4.AlltoD7;
title 'with weight2 as base Unstructure variance time*time full interactions no outpred '
class source ID trtmt sex;
model wts= source|time|trtmt  time*time time*time*trtmt time*time*source
  time*time*source*trtmt sex base / ddfm = kr solution
random int time / type =un sub = ID group = source;
run;
proc mixed data = agron4.AlltoD7;
title 'with weight2 as base Unstructure variance timt*time full interactions with
  outpred';
class source ID trtmt sex;
model wts= source|time|trtmt  time*time time*time*trtmt time*time*source
  time*time*source*trtmt sex base / ddfm = kr solution outpred = agron4.AllpredD7;
random int time / type =un sub = ID group = source;
run;

Note that the above model was used to generate predicted weight values for each
calf based upon the complete model. The predicted weight values are then sent to a
new file ("OUTPRED = agron4.Allpred7") which is subsequently analyzed to detect
main treatment differences (after arraying data to reflect the repeated measures
for each calf).

proc sort data= agron4.AllpredD7;
  by ID;
data agron4.predd7gains ; set agron4.AllpredD7;
  keep ID source sex trtmt base time wts pred pwt1 pwt2 pwt3 pwt4 date1 date2 date3
date4 date5 date6 ;
  by ID;
  if first.ID then do;
    pwt1 = . ;
    pwt2 = . ;
    pwt3 = . ;
    pwt4 = . ;
  end;
  if time = -2 then do;
    pwt1=pred;
  end;
  if time = -1 then do;
    pwt2=pred;
  end;
  if time = 0 then do;
    pwt3=pred;
  end;
  if time = 1 then do;
    pwt4=pred;
  end;
  if last.ID then output;
  retain ID pwt1-pwt4;
run;
data agron4.PredD7ADG ; set agron4.predd7gains  ;
  PredGain = pwt4 - pwt1;
  predADG = Predgain/(date6 - date3) ;
run;
proc glm data = agron4.PredD7ADG;
class trtmt;
model predGain= trtmt;
lsmeans trtmt / adjust = tukey;
title ' All calves predicted gains to D7 compare trtmts';
run;
proc mixed data = agron4.PredD7ADG;
class trtmt;
model predGain= trtmt;
lsmeans trtmt / adjust = tukey;
run;
```sas
proc glm data = agron4.PredD7ADG;
class trtmt;
model predADG = trtmt;
lsmeans trtmt / adjust = tukey;
title 'All calves predicted ADG to D7 compare trtmts';
run;

proc mixed data = agron4.PredD7ADG;
class trtmt;
model predADG = trtmt;
lsmeans trtmt / adjust = tukey;
run;
```

**Location #1, all calves from D-13 to D0 and -13 to D7**

This model examined the same time interval as above, but only examining the 1st location. Because only the one location was used, no GROUP function was included.

```sas
data agron4.temp ; set agron3.Lallkg;
keep ID trtmt sex staygo base date3 date4 date5 date6 kg3 kg4 kg5 kg6 ;
data agron4.LToD7; set agron4.temp;
array kgs{4} Kg;:
do i=1 to 4 ;
time = (i-4) + 1 ;
wts = kgs{i};
 output;
end;
run;

proc mixed data = agron4.LToD7;
title 'Lindley only with weight2 as base Unstructure variance timt*time full interactions no group ';
class ID trtmt sex;
model wts= time|trtmt  time*time time*time*trtmt  sex base / ddfm = kr solution;
random int time / type =un sub = ID ;
run;

proc mixed data = agron4.LToD7;
title 'Lindley only with weight2 as base Unstructure variance timt*time full interactions with outpred';
class ID trtmt sex;
model wts= time|trtmt  time*time time*time*trtmt  sex base / ddfm = kr solution
outpred = agron4.LpredD7;
random int time / type =un sub = ID ;
run;

proc sort data= agron4.LpredD7;
by ID;
data agron4.Lpredd7gains ; set agron4.LpredD7;
keep ID  sex trtmt base time wts pred pwt1 pwt2 pwt3 pwt4 date3 date4 date5 date6 ;
by ID;
if first.ID then do;
pwt1 = . ;
pwt2 = . ;
pwt3 = . ;
pwt4 = . ;
end;
if time = -2 then do;
pwt1=pred;
end;
if time = -1 then do;
pwt2=pred;
end;
```

if time = 0 then do;
pwt3=pred;
end;
if time = 1 then do;
pwt4=pred;
end;
if last.ID then output;
retain ID pwt1-pwt4;
run;
data agron4.LPredD7ADG ; set agron4.LpredD7gains ;
PredGain = pwt4 - pwt1;
predADG = Predgain/(date6 - date3) ;
run;
proc glm data = agron4.LPredD7ADG;
class trtmt;
model predGain = trtmt;
lsmeans trtmt / adjust = tukey;
title ' All calves predicted gains to D7 compare trtmts';
run;
proc mixed data = agron4.LPredD7ADG;
class trtmt;
model predGain = trtmt;
lsmeans trtmt / adjust = tukey;
run;
proc glm data = agron4.LPredD7ADG;
class trtmt;
model predADG = trtmt;
lsmeans trtmt / adjust = tukey;
title ' All calves predicted ADG to D7 compare trtmts';
run;
proc mixed data = agron4.LPredD7ADG;
class trtmt;
model predADG = trtmt;
lsmeans trtmt / adjust = tukey;
run;
proc mixed data = agron4.LPredD7ADG;
class trtmt;
model predADG = trtmt;
lsmeans trtmt / adjust = tukey;
title ' All calves predicted ADG to D7 compare trtmts';
run;
Location #2, all calves from D-13 to D0 and -13 to D7
This is the same program for location #2.
data agron4.temp ; set agron3.Rallkg;
keep ID trtmt sex staygo base date3 date4 date5 date6 kg3 kg4 kg5 kg6 ;
data agron4.RToD7; set agron4.temp;
array kgs{4} Kg;:
do i=1 to 4 ;
time = (i-4) +1 ;
wts = kgs[i];
output;
end;
run;
proc mixed data = agron4.RtoD7;
title 'Range only with weight2 as base Unstructure variance timt*time full
interactions no group ';
class  ID trtmt sex;
model wts= time|trtmt  time*time time*time*trtmt  sex base / ddfm = kr solution;
random int time / type =un sub = ID ;
run;
proc mixed data = agron4.RtoD7;
title 'Range only with weight2 as base Unstructure variance timt*time full
interactions with outpred';
class ID trtmt sex;
model wts= time|trtmt time*time time*time*time*trtmt sex base / ddfm = kr solution
outpred = agron4.RpredD7;
random int time / type =un sub = ID ;
run;
proc sort data= agron4.RpredD7;
by ID;
data agron4.RpredD7gains ; set agron4.RpredD7;
keep ID sex trtmt base time wts pred pwt1 pwt2 pwt3 pwt4 date3 date4 date5 date6 ;
by ID;
if first.ID then do;
pwt1 = . ;
pwt2 = . ;
pwt3 = . ;
pwt4 = . ;
end;
if time = -2 then do;
pwt1=pred;
end;
if time = -1 then do;
pwt2=pred;
end;
if time = 0 then do;
pwt3=pred;
end;
if time = 1 then do;
pwt4=pred;
end;
if last.ID then output;
retain ID pwt1-pwt4;
run;
data agron4.RPredD7ADG ; set agron4.RpredD7gains ;
PredGain = pwt4 - pwt1;
predADG = Predgain/(date6 - date3) ;
run;
proc glm data = agron4.RPredD7ADG;
class trtmt;
model predGain = trtmt;
lsmeans trtmt / adjust = tukey;
title ' All calves predicted gains to D7 compare trtmts' ;
run;
proc mixed data = agron4.RPredD7ADG;
class trtmt;
model predGain= trtmt;
lsmeans trtmt / adjust = tukey;
run;
proc glm data = agron4.RPredD7ADG;
class trtmt;
model predADG = trtmt;
lsmeans trtmt / adjust = tukey;
title ' All calves predicted ADG to D7 compare trtmts' ;
run;
proc mixed data = agron4.RPredD7ADG;
class trtmt;
model predADG= trtmt;
lsmeans trtmt / adjust = tukey;
run;
Both sources, abruptly weaned calves excluded; from D-13 to D28 and D7 to D28

This model excludes the abruptly weaned calves so that the effect of shipping on D7 vs. D28 can be assessed. It includes calves from both sources, and again uses ‘‘GROUP =’’ to account for heterogeneity of variance between the two sources. Multiple location interactions were again present, so each location was subsequently assessed individually (see below).

data agron4.temp; set agron3.noabrpt;
base = weight2/2.2;
kg3 = weight3/2.2;
kg4 = weight4/2.2;
kg5 = weight5/2.2;
kg6 = weight6/2.2;
kg7 = weight7/2.2;
kg8 = weight8/2.2;
run;
data agron4.temp2; set agron4.temp;
keep source ID staygo base sex trtmt date3 date4 date5 date6 date7 date8 kg3 kg4
kg5 kg6 kg7 kg8;
data agron4.noabrptalltime; set agron4.temp2;
keep source ID staygo base sex trtmt time wts date3 date4 date5 date6 date7 date8
;
array kgs{6} Kg:;
do i=1 to 6 ;
time = (i-4) +1 ;
wts = kgs(i);
output;
end;
run;
proc sort data= agron4.noabrptalltime;
by ID;
run;
proc mixed data = agron4.noabrptalltime;
class source ID trtmt staygo sex ;
model wts= source|trtmt|time|staygo time*time*time*trtmt
time*time*source|trtmt time*time*staygo time*time*source|staygo sex base /ddfm =
kr solution outpred = agron4.noabrptlong;
random int time / type = un sub = ID group = source;
title 'Both sources, no abrupt D-13 to D28';
run;
data agron4.temp2; set agron4.temp;
keep source ID staygo base sex trtmt date3 date6 date7 date8  kg6 kg7 kg8;
data agron4.noabprpt; set agron4.temp2;
keep source ID staygo base sex trtmt time wts date3 date6 date7 date8  ;
array kgs{3} Kg:;
do i=1 to 3 ;
time = (i-1) +1 ;
wts = kgs(i);
output;
end;
run;
proc sort data= agron4.noabprpt;
by ID;
run;
proc mixed data = agron4.noabprpt;
class source ID trtmt staygo sex ;
model wts= source|trtmt|time|staygo time*time*time|trtmt
time*time*source|trtmt sex base /ddfm = kr solution outpred = agron4.noabptshort;
random int time / type = un sub = ID group = source;
title 'Both sources, no abrupt ship to end';
run;
proc sort data= agron4.noabptlong;
by id;
data agron4.temp1 ; set agron4.noabptlong;
keep ID source staygo sex trtmt base time wts pred pwt1 pwt2 pwt3 pwt4 pwt5 pwt6 date3 date6 date8;
by id;
if first.ID then do;
pwt1 = . ;
pwt2 = . ;
pwt3 = . ;
pwt4 = . ;
pwt5 = . ;
pwt6 = . ;
end;
if time = -2 then do;
pwt1 = pred;
end;
if time = -1 then do;
pwt2 = pred;
end;
if time = 0 then do;
pwt3 = pred;
end;
if time = 1 then do;
pwt4 = pred;
end;
if time = 2 then do;
pwt5 = pred;
end;
if time =3 then do;
pwt6 = pred;
end;
if last.id then output;
retain ID pwt1-pwt6;
run;
data agron4.noabptLonggains ; set agron4.temp1;
predgain = pwt6 - pwt1;
predADG = Predgain/(date8 - date3);
run;
proc glm data = agron4.noabptlonggains;
class trtmt staygo ;
model predgain =trtmt staygo trtmt*staygo;
lsmeans trtmt / adjust = Tukey;
lsmeans staygo / adjust = tukey;
title 'Both sources no abrupt Predicted gains over full study';
run;
proc glm data = agron4.noabptlonggains;
class trtmt staygo;
model predADG = trtmt staygo trtmt*staygo;
lsmeans trtmt / adjust = tukey;
lsmeans staygo/ adjust = tukey;
title 'both sources no abrupt Predicted ADG over full study';
run;
proc sort data= agron4.noabptshort;
by id;
data agron4.temp1 ; set agron4.noabptshort;
keep ID source sex staygo trtmt base time wts pred pwt4 pwt5 pwt6 date3 date6 date8;
by id;
if first.ID then do;
pwt4 = . ;
pwt5 = . ;
pwt6 = . ;
end;
if time = 1 then do;
pwt4 = pred;
end;
if time = 2 then do;
pwt5 = pred;
end;
if time = 3 then do;
pwt6 = pred;
end;
if last.id then output;
retain ID pwt4-pwt6;
run;
data agron4.noabptshortgains ; set agron4.temp1;
predgain = pwt6 - pwt4;
predADG = Predgain/(date8 - date6);
run;
proc glm data = agron4.noabptshortgains;
class trtmt staygo;
model predgain =trtmt staygo trtmt*staygo;
lsmeans trtmt*staygo /  diff adjust = tukey;
title 'Both sources no abrupt Predicted gains post ship';
run;
proc glm data = agron4.noabptshortgains;
class trtmt staygo;
model predADG = trtmt staygo trtmt*staygo;
lsmeans trtmt*staygo / diff adjust = tukey;
title 'both sources no abrupt Predicted ADG post ship';
run;
quit;

Source #1 abruptly weaned calves excluded; D-13 to D28 and D7 to D28
The same approach as was used immediately above, only including location #1.

data agron4.lnoabrptfull; set agron3.lnoabpt;
base = weight2/2.2;
kg3 = weight3/2.2;
kg4 = weight4/2.2;
kg5 = weight5/2.2;
kg6 = weight6/2.2;
kg7 = weight7/2.2;
kg8 = weight8/2.2;
run;
data agron4.temp1; set agron4.lnoabrptfull;
keep ID staygo base sex trtmt date3 date4 date5 date6 date7 date8 kg3 kg4 kg5 kg6
kg7 kg8;
data agron4.lnoabrptalltime; set agron4.temp1;
keep ID staygo base sex trtmt time wts date3 date4 date5 date6 date7 date8 ;
array kgs{6} Kg;:
do i=1 to 6 ;
time = (i-4) +1 ;
wts = kgs(i);
output;
end;
run;
proc sort data= agron4.lnoabrptalltime;
by ID;
run;
proc mixed data = agron4.lnoabrptalltime;
class ID trtmt staygo sex ;
model wts = trtmt|time|staygo time*time time*trtmt time*time*staygo sex base
/ddfm = kr solution outpred = agron4.lnoabptlong;
random int time / type = un sub = ID;
title 'Lindley only, no abrupt D-13 to D28';
run;
data agron4.ltemp ; set agron4.temp1;
keep ID staygo base sex trtmt date3 date6 date8 kg6 kg7 kg8;
data agron4.lnoabrpt; set agron4.ltemp;
keep ID staygo base sex trtmt time wts date3 date6 date8 ;
array kgs{3} Kg; ;
do i=1 to 3 ;
time = (i-1) +1 ;
wts = kgs{i};
output;
end;
run;
proc sort data= agron4.lnoabrpt;
by ID;
run;
proc mixed data = agron4.lnoabrpt;
class  ID trtmt staygo sex ;
model wts= trtmt|time|staygo time*time time*trtmt sex base /ddfm = kr
solution outpred = agron4.Lnoabptshort;
random int time / type = un sub = ID ;
title 'Lindley only, no abrupt ship to end';
run;
proc sort data= agron4.Lnoabptlong;
by id;
data agron4.temp1 ; set agron4.Lnoabptlong;
keep ID staygo sex trtmt base time wts pred pwt1 pwt2 pwt3 pwt4 pwt5 pwt6 date3
date6 date8;
by id;
if first.ID then do;
pwt1 = . ;
pwt2 = . ;
pwt3 = . ;
pwt4 = . ;
pwt5 = . ;
pwt6 = . ;
end;
if time =  -2 then do;
pwt1 = pred;
end;
if time =  -1 then do;
pwt2 = pred;
end;
if time =  0 then do;
pwt3 = pred;
end;
if time =  1 then do;
pwt4 = pred;
end;
if time =  2 then do;
pwt5 = pred;
end;
if time = 3 then do;
pwt6 = pred;
end;
if last.ID then output;
retain ID pwt1-pwt6;
run;
data agron4.LnoabptLonggains ; set agron4.temp1;
predgain = pwt6 - pwt1;
predADG = Predgain/(date8 - date3);
run;
proc glm data = agron4.Lnoabptlonggains;
class trtmt staygo ;
model predgain =trtmt staygo trtmt*staygo;
lsmeans trtmt / adjust = Tukey;
lsmeans staygo / adjust = tukey;
lsmeans trtmt*staygo / diff adjust = tukey;
title 'Lindley no abrupt Predicted gains over full study';
run;
proc glm data = agron4.Lnoabptlonggains;
class trtmt staygo;
model predADG = trtmt staygo trtmt*staygo;
lsmeans trtmt / adjust = tukey;
lsmeans staygo/ adjust = tukey;
lsmeans trtmt*staygo / diff adjust= tukey;
title 'Lindley no abrupt Predicted ADG over full study';
run;
proc sort data= agron4.Lnoabptshort;
by id;
data agron4.temp1 ; set agron4.Lnoabptshort;
keep ID sex staygo trtmt base time wts pred  pwt4 pwt5 pwt6 date3 date6 date8;
by id;
if first.ID then do;
pwt4 = .;
pwt5 = . ;
pwt6 = . ;
end;
if time = 1 then do;
pwt4 = pred;
end;
if time = 2 then do;
pwt5 = pred;
end;
if time =3 then do;
pwt6 = pred;
end;
if last.id then output;
retain ID pwt4-pwt6;
run;
data agron4.Lnoabptshortgains ; set agron4.temp1;
predgain = pwt6 - pwt4;
predADG = Predgain/(date8 - date6);
run;
proc glm data = agron4.Lnoabptshortgains;
class trtmt staygo;
model predgain =trtmt staygo trtmt*staygo;
lsmeans trtmt*staygo / diff adjust = tukey;
title 'Lindley no abrupt Predicted gains post ship';
run;
proc glm data = agron4.Lnoabptshortgains;
class trtmt staygo;
model predADG = trtmt staygo trtmt*staygo;
lsmeans trtmt*staygo / diff adjust = tukey;
title 'Lindley no abrupt Predicted ADG post ship';
run;
quit;
Source #2 abruptly weaned calves excluded; D-13 to D28 and D7 to D28
Same approach as used above, only including calves from location #2.

```r
data agron4.Rnoabrptfull; set agron3.Rnoabpt;
base = weight2/2.2;
kg3 = weight3/2.2;
kg4 = weight4/2.2;
kg5 = weight5/2.2;
kg6 = weight6/2.2;
kg7 = weight7/2.2;
kg8 = weight8/2.2;
run;
data agron4.temp1; set agron4.Rnoabrptfull;
keep ID staygo base sex trtmt date3 date4 date5 date6 date7 date8 kg3 kg4 kg5 kg6 kg7 kg8;
data agron4.Rnoabrptalltime; set agron4.temp1;
keep ID staygo base sex trtmt time wts date3 date4 date5 date6 date7 date8;
array kgs{6} Kg;=
do i=1 to 6;
time = (i-4) + 1;
wts = kgs{i};
output;
end;
run;
proc sort data= agron4.Rnoabrptalltime;
by ID;
run;
proc mixed data = agron4.Rnoabrptalltime;
class ID trtmt staygo sex;
model wts= trtmt|time|staygo time*time*time*trtmt time*time*staygo sex base
/ddfm = kr solution outpred = agron4.Rnoabptlong;
random int time / type = un sub = ID;
title 'Range only, no abrupt D-13 to D28';
run;
data agron4.Rtemp ; set agron4.Rnoabrpt;
keep ID staygo base sex trtmt date3 date6 date8 kg6 kg7 kg8;
data agron4.Rnoabrpt; set agron4.Rtemp;
keep ID staygo base sex trtmt time wts date3 date6 date8;
array kgs{3} Kg;=
do i=1 to 3;
time = (i-1) + 1;
wts = kgs{i};
output;
end;
run;
proc sort data= agron4.Rnoabrpt;
by ID;
run;
proc mixed data = agron4.Rnoabrpt;
class ID trtmt staygo sex;
model wts= trtmt|time|staygo time*time*time*trtmt sex base /ddfm = kr
solution outpred = agron4.Rnoabptshort;
random int time / type = un sub = ID;
title 'Range only, no abrupt ship to end';
run;
proc sort data= agron4.Rnoabptlong;
by id;
data agron4.temp1 ; set agron4.Rnoabptlong;
keep ID staygo sex trtmt base time wts pred pwt1 pwt2 pwt3 pwt4 pwt5 pwt6 date3
date6 date8;
by id;
if first.ID then do;
```
pwt1 = .;
pwt2 = .;
pwt3 = .;
pwt4 = .;
pwt5 = .;
pwt6 = .;
end;
if time = -2 then do;
pwt1 = pred;
end;
if time = -1 then do;
pwt2 = pred;
end;
if time = 0 then do;
pwt3 = pred;
end;
if time = 1 then do;
pwt4 = pred;
end;
if time = 2 then do;
pwt5 = pred;
end;
if time = 3 then do;
pwt6 = pred;
end;
if last.id then output;
retain ID pwt1-pwt6;
run;
data agron4.RnoabptLonggains ; set agron4.temp1;
predgain = pwt6 - pwt1;
predADG = Predgain/(date8 - date3);
run;
proc glm data = agron4.Rnoabptlonggains;
class trtmt staygo ;
model predgain =trtmt staygo trtmt*staygo;
lsmeans trtmt / adjust = Tukey;
lsmeans staygo / adjust = tukey;
lsmeans trtmt*staygo / diff adjust = tukey;
title 'Range no abrupt Predicted gains over full study';
run;
proc glm data = agron4.Rnoabptlonggains;
class trtmt staygo;
model predADG = trtmt staygo trtmt*staygo;
lsmeans trtmt / adjust = tukey;
lsmeans staygo / adjust = tukey;
lsmeans trtmt*staygo / diff adjust = tukey;
title 'Range no abrupt Predicted ADG over full study';
run;
proc sort data= agron4.Rnoabptshort;
by id;
data agron4.temp1 ; set agron4.Rnoabptshort;
keep ID sex staygo trtmt base time wts pred  pwt4 pwt5 pwt6 date3 date6 date8;
by id;
if first.ID then do;
pwt4 = .;
pwt5 = . ;
pwt6 = . ;
end;
if time = 1 then do;
pwt4 = pred;
end;
if time = 2 then do;
Both sources, calves that stayed at ranch & AW-I, D-13 to D28
This program examined all calves that remained on the ranch until D28 (excludes those shipped on D7). The
AW-I group was retained as a negative control to compare each long-term retained treatment to a negative
control of abrupt weaning with immediate shipment. As with previous attempts, location interactions
necessitated examination of the locations separately.
CLASS source ID trtmt sex;
MODEL wts = source|trtmt|time time*time time*time|trtmt time*time|source|trtmt sex base /ddfm = kr solution outpred = agron4.AClong;
RANDOM int time / type = un sub = ID group = source;
title 'Both sources, A and C only D-13 to D28';
RUN;
DATA agron4.temp2; set agron4.temp;
keep source ID base sex trtmt date3 date6 date7 date8 kg6 kg7 kg8;
DATA agron4.ACD7D28; set agron4.temp2;
keep source ID base sex trtmt time wts date3 date6 date7 date8;
array kgs{3} Kg:;
do i=1 to 3;
time = (i-1) + 1;
wts = kgs{i};
output;
end;
RUN;
PROC SORT data= agron4.ACD7D28;
by ID;
RUN;
PROC MIXED data = agron4.ACD7D28;
CLASS source ID trtmt sex;
MODEL wts = source|trtmt|time time*time time*time|trtmt time*time|source|trtmt sex base /ddfm = kr solution outpred = agron4.ACshort;
RANDOM int time / type = un sub = ID group = source;
title 'Both sources, A & C only D7 to D28';
RUN;
PROC SORT data= agron4.AClong;
by id;
DATA agron4.temp1; set agron4.AClong;
keep ID source sex trtmt base time wts pred pwt1 pwt2 pwt3 pwt4 pwt5 pwt6 date3 date6 date8;
by id;
if first.ID then do;
pwt1 = .;
pwt2 = .;
pwt3 = .;
pwt4 = .;
pwt5 = .;
pwt6 = .;
end;
if time = -2 then do;
pwt1 = pred;
end;
if time = -1 then do;
pwt2 = pred;
end;
if time = 0 then do;
pwt3 = pred;
end;
if time = 1 then do;
pwt4 = pred;
end;
if time = 2 then do;
pwt5 = pred;
end;
if time =3 then do;
pwt6 = pred;
end;
if last.id then output;
retain ID pwt1-pwt6;
RUN;
data agron4.AClonggains; set agron4.temp1;
predgain = pwt6 - pwt1;
predADG = Predgain/(date8 - date3);
run;
proc glm data = agron4.AClonggains;
class trtmt ;
model predgain =trtmt ;
lsmeans trtmt / adjust = Tukey;
title 'Both sources A & C only Predicted gains over full study';
run;
proc glm data = agron4.AClonggains;
class trtmt ;
model predADG = trtmt ;
lsmeans trtmt / adjust = tukey;
title 'both sources A & C Predicted ADG over full study';
run;
proc sort data= agron4.ACshort;
by id;
data agron4.temp1 ; set agron4.ACshort;
keep ID source sex trtmt base time wts pred  pwt4 pwt5 pwt6 date3 date6 date8;
by id;
if first.ID then do;
pwt4 = .;
pwt5 = . ;
pwt6 = . ;
end;
if time = 1 then do;
pwt4 = pred;
end;
if time = 2 then do;
pwt5 = pred;
end;
if time =3 then do;
pwt6 = pred;
end;
if last.id then output;
retain ID pwt4-pwt6;
run;
data agron4.ACshortgains ; set agron4.temp1;
predgain = pwt6 - pwt4;
predADG = Predgain/(date8 - date6);
run;
proc glm data = agron4.ACshortgains;
class trtmt ;
model predgain =trtmt ;
lsmeans trtmt / adjust = tukey;
title 'Both sources A & C Predicted gains post ship';
run;
proc glm data = agron4.ACshortgains;
class trtmt ;
model predADG = trtmt ;
lsmeans trtmt / adjust = tukey;
title 'both sources A & C Predicted ADG post ship';
run;
quit;

Source #1, calves that stayed at ranch & AW-I; various time periods
Assessment of D28 groups with AW-i as negative control, for location #1 only.
data agron4.AOnlyL; set agron4.LAOnly;
base = weight2/2.2;
kg3 = weight3/2.2;
kg4 = weight4/2.2;
kg5 = weight5/2.2;
kg6 = weight6/2.2;
kg7 = weight7/2.2;
kg8 = weight8/2.2;

run;
data agron4.Ltemp; set agron4.AConlyL;
keep ID base sex trtmt date3 date4 date5 date6 date7 date8 kg3 kg4 kg5 kg6 kg7 kg8;
data agron4.AConlyforL; set agron4.Ltemp;
keep ID base sex trtmt time wts date3 date4 date5 date6 date7 date8 ;
array kgs{6} Kg:;
do i=1 to 6 ;
time = (i-4) +1 ;
wts = kgs{i};
output;
end;
run;
proc sort data= agron4.AConlyforl;
by ID;
run;
proc mixed data = agron4.AConlyforl;
class ID  trtmt sex ;
model wts= trtmt*time time*time time*time*trtmt  sex base /ddfm = kr solution
outpred = agron4.AConlyforLlong;
store agron4.LACTemp;
random int time / type = un sub = ID ;
lsmeans trtmt / diff ;
title 'Grps A & C from Lindley only D-13 to D28';
run;
Proc PLM restore = agron4.LACTemp;
estimate 'slope 24' time 1 trtmt*time 1 0 0 0 ,
'slope Abrupt' time 1 trtmt*time 0 1 0 0 ,
'slope fence' time 1 trtmt*time 0 0 1 0 ,
'slope flap' time 1 trtmt*time 0 0 0 1 / e;
proc sort data= agron4.AConlyforllong;
by id;
data agron4.LACtemp ; set agron4.AConlyforllong;
keep ID sex trtmt base time wts pred pwt1 pwt2 pwt3 pwt4 pwt5 pwt6 date3 date6
date8;
by id;
if first.ID then do;
pwt1 = . ;
pwt2 = . ;
pwt3 = . ;
pwt4 = . ;
pwt5 = . ;
pwt6 = . ;
end;
if time = -2 then do;
pwt1 = pred;
end;
if time = -1 then do;
pwt2 = pred;
end;
if time = 0 then do;
pwt3 = pred;
end;
if time = 1 then do;
pwt4 = pred;
end;
if time = 2 then do;
pwt5 = pred;
end;
if time = 3 then do;
pwt6 = pred;
end;
if last.id then output;
retain ID pwt1-pwt6;
run;
data agron4.AConlyLLonggains ; set agron4.LACtemp;
predgain = pwt6 - pwt1;
predADG = Predgain/(date8 - date3);
run;
proc glm data = agron4.AConlyLLonggains;
class trtmt ;
model predgain = trtmt;
lsmeans trtmt / adjust = Tukey;
title 'Grps A & C from Lindley only Predicted gains over full study';
run;
proc glm data = agron4.AConlyLLonggains;
class trtmt ;
model predADG = trtmt ;
lsmeans trtmt / adjust = tukey;
title 'A & C from Lindley only Predicted ADG over full study';
run;
data agron4.Ltemp; set agron4.AConlyL;
keep ID base sex trtmt date3 date4 date5 date6 date7 date8 kg6 kg7 kg8;
data agron4.ACLD7D28; set agron4.Ltemp;
keep ID base sex trtmt time wts date3 date4 date5 date6 date7 date8 ;
array kgs\{3\} Kg:\;
do i=1 to 3 ;
time = (i-1) + 1 ;
wts = kgs(i);
output;
end;
run;
proc sort data= agron4.ACLD7D28;
by ID;
run;
proc mixed data = agron4.ACLD7D28;
class ID trtmt sex ;
model wts= trtmt*time time*time*time*time*trtmt  sex base /ddfm = kr solution
outpred = agron4.AConlyforLshort;
store agron4.LACTemp2;
random int time / type = un sub = ID ;
lsmeans trtmt / diff ;
title 'Grps A & C from Lindley only D7 to D28';
run;
Proc PLM restore = agron4.LACTemp2;
estimate 'slope 24' time 1 trtmt*time 1 0 0 0 ,
'slope Abrupt' time 1 trtmt*time 0 1 0 0 ,
'slope fence' time 1 trtmt*time 0 0 1 0 ,
'slope flap' time 1 trtmt*time 0 0 0 1 / e;
data agron4.LACTemp2 ; set agron4.AConlyforLshort;
keep ID sex trtmt base time wts pred pwt1 pwt2 pwt3 date3 date6 date8;
by id;
if first.ID then do;
pwt1 = . ;
pwt2 = . ;
pwt3 = . ;
pwt4 = . ;
pwt5 = . ;
pwt6 = . ;
end;
if time = 1 then do;
pwt1 = pred;
end;
if time = 2 then do;
pwt2 = pred;
end;
if time = 3 then do;
pwt3 = pred;
end;
if last.id then output;
retain ID pwt1-pwt3;
run;
data agron4.AConlyLshortgains ; set agron4.LACtemp2;
predgain = pwt3 - pwt1;
predADG = Predgain/(date8 - date6);
run;
proc glm data = agron4.AConlyLshortgains;
class trtmt ;
model predgain =trtmt;
lsmeans trtmt / adjust = Tukey;
title 'Grps A & C from Lindley only Predicted gains D7 to D28';
run;
proc glm data = agron4.AConlyLshortgains;
class trtmt ;
model predADG = trtmt ;
lsmeans trtmt / adjust = tukey;
title 'A & C from Lindley only Predicted ADG D7 to D28';
run;quit;

Source #2, calves that stayed at ranch & AW-I; various time intervals
Assessment of D28 groups with AW-I as negative control, for location #2 only.

data agron4.AConlyR; set agron4.RAConly;
base = weight2/2.2;
kg3 = weight3/2.2;
kg4 = weight4/2.2;
kg5 = weight5/2.2;
kg6 = weight6/2.2;
kg7 = weight7/2.2;
kg8 = weight8/2.2;
run;
data agron4.Rtemp; set agron4.AConlyR;
keep ID base sex trtmt date3 date4 date5 date6 date7 date8 kg3 kg4 kg5 kg6 kg7
kg8;
data agron4.AConlyforR; set agron4.Rtemp;
keep ID base sex trtmt time wts date3 date4 date5 date6 date7 date8 ;
array kgs{6} Kg:;
do i=1 to 6 ;
time = (i-4) +1 ;
wts = kgs{i};
output;
end;
run;
proc sort data= agron4.AConlyforR;
by ID;
run;
proc mixed data = agron4.AConlyforR;
class ID trtmt sex;
model wts= trtmt|time time*time time*time*trtmt sex base /ddfm = kr solution
outpred = agron4.AConlyforRlong;
random int time / type = un sub = ID;
lsmmeans trtmt / diff;
title 'Grps A & C from Range only D-13 to D28';
run;
proc sort data= agron4.AConlyforRlong;
by id;
data agron4.RACtemp ; set agron4.AConlyforRlong;
keep ID sex trtmt base time wts pred pwt1 pwt2 pwt3 pwt4 pwt5 pwt6 date3 date6
  date8;
by id;
if first.ID then do;
pwt1 = .;
pwt2 = .;
pwt3 = .;
pwt4 = .;
pwt5 = .;
pwt6 = .;
end;
if time = -2 then do;
pwt1 = pred;
end;
if time = -1 then do;
pwt2 = pred;
end;
if time = 0 then do;
pwt3 = pred;
end;
if time = 1 then do;
pwt4 = pred;
end;
if time = 2 then do;
pwt5 = pred;
end;
if time =3 then do;
pwt6 = pred;
end;
if last.id then output;
retain ID pwt1-pwt6;
run;
data agron4.AConlyRLonggains ; set agron4.RACtemp;
predgain = pwt6 - pwt1;
predADG = Predgain/(date8 - date3);
run;
proc glm data = agron4.AConlyRlonggains;
class trtmt ;
model predgain =trtmt;
lsmmeans trtmt / adjust = Tukey;
title 'Grps A & C from Range only Predicted gains over full study';
run;
proc glm data = agron4.AConlyRlonggains;
class trtmt ;
model predADG = trtmt ;
lsmmeans trtmt / adjust = tukey;
title 'A & C from Range only Predicted ADG over full study';
run;
data agron4.Rtemp; set agron4.AConlyR;
keep ID base sex trtmt date3 date4 date5 date6 date7 date8 kg6 kg7 kg8;
data agron4.ACRD7D28; set agron4.Rtemp;
keep ID base sex trtmt time wts date3 date4 date5 date6 date7 date8;
array kgs{3} Kg::;
do i=1 to 3;
time = (i-1) + 1;
  wts = kgs{i};
  output;
end;
run;
proc sort data= agron4.ACRD7D28;
by ID;
run;
proc mixed data = agron4.ACRD7D28;
class ID  trtmt sex ;
model wts= trtmt|time time*time*time*time*time*trtmt  sex base /ddfm = kr solution
  outpred = agron4.AConlyforRshort;
random int time / type = un sub = ID ;
lsmeans trtmt / diff ;
title 'Grps A & C from Range only D7 to D28';
run;
data agron4.RACtemp2 ; set agron4.AConlyforRshort;
keep ID sex trtmt base time wts pred pwt1 pwt2 pwt3 date3 date6 date8;
by id;
if first.ID then do;
pwt1 = .;
pwt2 = .;
pwt3 = .;
pwt4 = .;
pwt5 = .;
pwt6 = .;
end;
if time = 1 then do;
pwt1 = pred;
end;
if time = 2 then do;
pwt2 = pred;
end;
if time =3 then do;
pwt3 = pred;
end;
if last.id then output;
retain ID pwt1-pwt3;
run;
data agron4.AConlyRshortgains ; set agron4.RACtemp2;
predgain = pwt3 - pwt1;
predADG = Predgain/(date8 - date6);
run;
proc glm data = agron4.AConlyRshortgains;
class trtmt ;
model predgain =trtmt;
lsmeans trtmt / adjust = Tukey;
title 'Grps A & C from Range only Predicted gains D7 to D28';
run;
proc glm data = agron4.AConlyRshortgains;
class trtmt ;
model predADG = trtmt ;
lsmeans trtmt / adjust = tukey;
title 'A & C from Range only Predicted ADG D7 to D28';
run;quit;
Both sources, all calves (treatment groups and ship dates combined into single trtmt classification); D-13 to D28
A single variable was created to combine both weaning method and shipment day for all calves. This model examined the full study period for both locations. The locations are examined separately below.

```plaintext
data agron4.temp; set agron3.Allstrt;
base = weight2/2.2;
kg3 = weight3/2.2;
kg4 = weight4/2.2;
kg5 = weight5/2.2;
kg6 = weight6/2.2;
kg7 = weight7/2.2;
kg8 = weight8/2.2;
run;
data agron4.temp2; set agron4.temp;
keep source ID base sex strt date3 date4 date5 date6 date7 date8 kg3 kg4 kg5 kg6 kg7 kg8;
data agron4ISTRTalltime; set agron4.temp2;
keep source ID base sex strt time wts date3 date4 date5 date6 date7 date8 ;
array kgs{6} Kg;;
do i=1 to 6 ;
time = (i-4) +1 ;
wts = kgs{i};
output;
end;
run;
proc sort data= agron4ISTRTalltime;
by ID;
run;
proc mixed data = agron4ISTRTalltime;
class source ID strt sex ;
model wts= source|strt|time time*time|time*strt time*time|source|strt sex base /ddfm = kr solution outpred = agron4ISTRTlong;
random int time / type = un sub = ID group = source;
title 'Both sources, STRT D-13 to D28';
run;
proc sort data= agron4ISTRTlong;
by id;
data agron4.tempSTRT ; set agron4ISTRTlong;
keep ID source sex strt base time wts pred pwt1 pwt2 pwt3 pwt4 pwt5 pwt6 date3 date6 date8;
by id;
if first.ID then do;
pwt1 = . ;
pwt2 = . ;
pwt3 = . ;
pwt4 = . ;
pwt5 = . ;
pwt6 = . ;
end;
if time = -2 then do;
pwt1 = pred;
end;
if time = -1 then do;
pwt2 = pred;
end;
if time = 0 then do;
pwt3 = pred;
end;
if time = 1 then do;
pwt4 = pred;
```

end;
if time = 2 then do;
pwt5 = pred;
end;
if time = 3 then do;
pwt6 = pred;
end;
if last.id then output;
retain ID pwt1-pwt6;
run;
data agron4.STRTLlonggains ; set agron4.tempSTRT;
predgain = pwt6 - pwt1;
predADG = Predgain/(date8 - date3);
run;
proc glm data = agron4.STRTLlonggains;
class strt ;
model predgain =strt ;
lsmeans strt / adjust = Tukey;
title 'Both sourcesSTRT Predicted gains over full study';
run;
proc glm data = agron4.STRTLlonggains;
class strt ;
model predADG = strt ;
lsmeans strt / adjust = tukey;
title 'both sources STRT Predicted ADG over full study';
run;
quit;

Source #1, all calves (treatment groups and ship dates combined into single trtmt classification); D-13 to D28
A single variable was created to combine both weaning method and shipment day for all calves. This model examined the full study period for location #1 only.
model wts = strt | time time*time time*time time*time*strt sex base / ddfm = kr solution outpred = agron4.StrtforLlong;
store agron4.LSTRTTemp;
random int time / type = un sub = ID;
lsmeans strt / diff;
title 'STRT from Lindley only D-13 to D28';
run;

Proc PLM restor = agron4.LGrpATemp;
estimate 'slope 24' time 1 strt*time 1 0 0 0 ,
'slope Abrupt' time 1 strt*time 0 1 0 0 ,
'slope fence' time 1 strt*time 0 0 1 0 ,
'slope flap' time 1 strt*time 0 0 0 1 / e;
proc sort data= agron4.STRTforllong;
by id;
data agron4.LtempSTRT ; set agron4.STRTforllong;
keep ID sex strt base time wts pred pwt1 pwt2 pwt3 pwt4 pwt5 pwt6 date3 date6
date8;
by id;
if first.ID then do;
pwt1 = . ;
pwt2 = . ;
pwt3 = . ;
pwt4 = . ;
pwt5 = . ;
pwt6 = . ;
end;
if time = -2 then do;
pwt1 = pred;
end;
if time = -1 then do;
pwt2 = pred;
end;
if time = 0 then do;
pwt3 = pred;
end;
if time = 1 then do;
pwt4 = pred;
end;
if time = 2 then do;
pwt5 = pred;
end;
if time =3 then do;
pwt6 = pred;
end;
if last.id then output;
retain ID pwt1-pwt6;
run;
data agron4.STRTforLLonggains ; set agron4.LtempSTRT;
predgain = pwt6 - pwt1;
predADG = Predgain/(date8 - date3);
run;
proc glm data = agron4.STRTforLlonggains;
class strt ;
model predgain =strt;
lsmeans strt / adjust = Tukey;
title 'STRT from Lindley only Predicted gains over full study';
run;
proc glm data = agron4.STRTforLlonggains;
class strt ;
model predADG = strt ;
lsmeans strt / adjust = tukey;
title 'STRT from Lindley only Predicted ADG over full study';
run;
quit;

Source #2, all calves (treatment groups and ship dates combined into single trtmt classification); D-13 to D28
A single variable was created to combine both weaning method and shipment day for all calves. This model examined the full study period for location #2 only.

data agron4.StrtonlyR; set agron4.RStrt;
  base = weight2/2.2;
  kg3 = weight3/2.2;
  kg4 = weight4/2.2;
  kg5 = weight5/2.2;
  kg6 = weight6/2.2;
  kg7 = weight7/2.2;
  kg8 = weight8/2.2;
run;

data agron4.Rtemp; set agron4.StrtonlyR;
  keep ID base sex strt date3 date4 date5 date6 date7 date8 kg3 kg4 kg5 kg6 kg7 kg8;
data agron4.StrtonlyforR; set agron4.Rtemp;
  keep ID base sex strt time wts date3 date4 date5 date6 date7 date8;
array kgs{6} Kg:;
do i=1 to 6;
time = (i-4) + 1;
wts = kgs[i];
  output;
end;
run;
proc sort data= agron4.strtonlyforR;
  by ID;
run;
proc mixed data = agron4.strtOnlyforR;
  class ID  strt sex ;
  model wts= strt*time*time time*strt  sex base /ddfm = kr solution
  outpred = agron4.StrtforRLong;
  store agron4.RSTRTTemp;
  random int time / type = un sub = ID ;
lsmeans strt / diff ;
title 'STRT from Range only D-13 to D28';
run;

Proc PLM restore = agron4.RGrpATemp;
estimate 'slope 24' time 1 strt*time 1 0 0 0 ,
  'slope Abrupt' time 1 strt*time 0 1 0 0 ,
  'slope fence' time 1 strt*time 0 0 1 0 ,
  'slope flap' time 1 strt*time 0 0 0 1 / e;
proc sort data= agron4.STRTforRLong;
  by id;
data agron4.RtempSTRT ; set agron4.STRTforRLong;
  keep ID sex strt base time wts pred pwt1 pwt2 pwt3 pwt4 pwt5 pwt6 date3 date6
  date8;
  by id;
  if first.ID then do;
pwt1 = . ;
pwt2 = . ;
pwt3 = . ;
pwt4 = . ;
pwt5 = .;
pwt6 = .;
end;
if time = -2 then do;
pwt1 = pred;
end;
if time = -1 then do;
pwt2 = pred;
end;
if time = 0 then do;
pwt3 = pred;
end;
if time = 1 then do;
pwt4 = pred;
end;
if time = 2 then do;
pwt5 = pred;
end;
if time = 3 then do;
pwt6 = pred;
end;
if last.id then output;
retain ID pwt1-pwt6;
run;
data agron4.STRTforRLonggains; set agron4.RtempSTRT;
predgain = pwt6 - pwt1;
predADG = Predgain/(date8 - date3);
run;
proc glm data = agron4.STRTforRLonggains;
class strt ;
model predgain = strt;
lsmeans strt / adjust = Tukey;
title 'STRT from Range only Predicted gains over full study';
run;
proc glm data = agron4.STRTforRLonggains;
class strt ;
model predADG = strt ;
lsmeans strt / adjust = tukey;
title 'STRT from Range only Predicted ADG over full study';
run;
quit;

Graphs were made for both the actual performance and predicted weights from the full model. For the actual performance the code is:

data agron4.temp; set agron3.Allstrt;
kg2 = weight2/2.2;
kg3 = weight3/2.2;
kg4 = weight4/2.2;
kg5 = weight5/2.2;
kg6 = weight6/2.2;
kg7 = weight7/2.2;
kg8 = weight8/2.2;
run;
data agron4.temp2; set agron4.temp;
keep strt kg2 kg3 kg4 kg5 kg6 kg7 kg8;
run;
proc sort data= agron4.temp2;
by strt;
run;
*proc means data = agron4.temp2;*
by strt;
var kg2 kg3 kg4 kg5 kg6 kg7 kg8;
output out = agron4.Strtplaymean mean= / autoname;
*run;*
data agron4.Strtplayintermed ; set agron4.Strtplaymean ;
kg2 = kg2_Mean ;
kg3 = kg3_Mean ;
kg4 = kg4_mean ;
kg5 = kg5_mean;
kg6 = kg6_mean;
kg7 = kg7_Mean;
kg8 = kg8_mean;
keep strt kg2 kg3 kg4 kg5 kg6 kg7 kg8;
*run;*
data agron4.Strtplayfinal; set agron4.Strtplayintermed;
array kgs{7} kg:;
do i =1 to 7;
time = (i-4) +1;
Means = kgs{i};
output;
end;
*run;*
*proc sgplot data = agron4.Strtplayfinal ;*
series y=Means x = time / group = strt;
*run;*
quit;

For plotting of the predicted weights (which were generated previously; see above):

*proc sort data = agron4.tempstrt;*
by strt;
*run;*
data agron4.predplay; set agron4.tempstrt;
keep strt pwt0 pwt1 pwt2 pwt3 pwt4 pwt5 pwt6 ;
pwt0 = base;
*run;*
*proc means data = agron4.predplay;*
by strt;
var pwt0 pwt1 pwt2 pwt3 pwt4 pwt5 pwt6 ;
output out = agron4.predplaymean mean= / autoname;
*run;*
data agron4.predplayintermed ; set agron4.predplaymean ;
kg2 = pwt0_Mean ;
kg3 = pwt1_Mean ;
kg4 = pwt2_mean ;
kg5 = pwt3_mean;
kg6 = pwt4_mean;
kg7 = pwt5_Mean;
kg8 = pwt6_mean;
keep strt kg2 kg3 kg4 kg5 kg6 kg7 kg8;
*run;*
data agron4.predplayfinal; set agron4.predplayintermed;
array kgs{7} kg:;
do i =1 to 7;
time = (i-4) +1;
Means = kgs{i};
output;
end;
run;
  proc sgplot data = agron4.predplayfinal ;
series y=means x = time / group = strt;
run;
quit;
Supplemental Material S2: Example of SAS output

The Mixed Procedure

**Model Information**

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Trtmt  5  24hr ablv abst fenc flap

Class Level Information

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Dimensions

- Covariance Parameters: 7
- Columns in X: 52
- Columns in Z per Subject: 4
- Subjects: 293
- Max Obs per Subject: 6

Number of Observations

- Number of Observations Read: 1794
- Number of Observations Used: 1724
- Number of Observations Not Used: 70

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Convergence criteria met.

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Fit Statistics

-2 Res Log Likelihood: 11575.7
AIC (Smaller is Better): 11589.7
AICC (Smaller is Better): 11589.7
BIC (Smaller is Better): 11615.4

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Solution for Fixed Effects

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## Solution for Fixed Effects

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### Solution for Fixed Effects

| Effect                     | source Trmt | Sex | Estimate | Standard Error | DF  | t Value | Pr > |t| |
|----------------------------|-------------|-----|----------|----------------|-----|---------|------|---|
| time*time*sour*Trtmt L     | fenc        |     | -0.2392  | 0.1770         | 1131| -1.35   | 0.1769 | |
| time*time*sour*Trtmt L     | flap        |     | 0        |                | .   | .       | .     |   |
| time*time*sour*Trtmt R     | 24hr        |     | 0.5043   | 0.2878         | 1140| 1.75    | 0.0800 | |
| time*time*sour*Trtmt R     | ablv        |     | 0.5600   | 0.3494         | 1131| 1.60    | 0.1093 | |
| time*time*sour*Trtmt R     | abst        |     | 0.5732   | 0.3390         | 1131| 1.69    | 0.0912 | |
| time*time*sour*Trtmt R     | fenc        |     | 0.1743   | 0.2826         | 1130| 0.62    | 0.5376 | |
| time*time*sour*Trtmt R     | flap        |     | 0        |                | .   | .       | .     |   |
| Sex                        | C           |     | -1.4574  | 0.7414         | 281 | -1.97   | 0.0503 | |
| Sex                        | S           |     | 0        |                | .   | .       | .     |   |
| base                       |             |     | 1.0093   | 0.01164        | 279 | 86.68   | <.0001 | |

### Type 3 Tests of Fixed Effects

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- Maximum: 3.3476
- Std Dev: 0.8772

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The Mixed Procedure

**Restricted Likelihood Distance**

Distance

Deleted ID
Fixed Effects Deletion Estimates for wts

- Intercept
- source L
- time
- time*source L

Deleted ID
Fixed Effects Deletion Estimates for wts

Trtmt 24hr

Trtmt ablv

Trtmt abst

Trtmt fenc

Deleted ID
Fixed Effects Deletion Estimates for wts

- source*Ttnt L 24hr
- source*Ttnt L ablv
- source*Ttnt L abst
- source*Ttnt L fenc

Deleted ID
Fixed Effects Deletion Estimates for wts

time*Trtmt 24hr

time*Trtmt ablv

time*Trtmt abst

time*Trtmt fenc

Deleted ID
Fixed Effects Deletion Estimates for wts

```
time*time*sour*Trtmt R abst
```

```
time*time*sour*Trtmt R fenc
```

```
Sex C
```

```
base
```

Deleted ID
Covariance Parameter Deletion Estimates for wts

UN(1,1) ID source L

UN(2,1) ID source L

UN(2,2) ID source L

UN(1,1) ID source R

Deleted ID
Covariance Parameter Deletion Estimates for wts

UN(2,1) ID source R

UN(2,2) ID source R

Residual

Deleted ID
The Mixed Procedure

Model Information

Data Set
    AGRON3.ALLSTEP1

Dependent Variable
    wts

Covariance Structure
    Unstructured

Subject Effect
    ID

Group Effect
    source

Estimation Method
    REML

Residual Variance Method
    Profile

Fixed Effects SE Method
    Kenward-Roger

Degrees of Freedom Method
    Kenward-Roger

Class Level Information

    Class   Levels  Values
    source    2  L R
    ID        293  
               1001 1002 1003 1005 1006 1007 1008 1009 1010 1011 1012 1013 1015
               1016 1017 1018 1019 1021 1022 1023 1024 1025 1026 1027 1028 1029
               1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1041 1042
               1044 1045 1046 1047 1048 1049 1050 1051 1052 1053 1054 1055 1056
               1057 1058 1059 1060 1061 1062 1063 1064 1065 1066 1067 1068 1069
               1070 1071 1072 1073 1074 1075 1076 1077 1078 1079 1080 1081 1082
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// all calves time*time interactions with outpred
Class Level Information

Class    Levels    Values
  1280 1281 1282 1283 1284 1285 1286 1287 1288 1289 1290 1291 1292
  1293 1294 1295 1296 1297 1298 1299

Trtmt    dummy     Sex
  5          6          2      C S

24hr ablv abst fenc flap

Dimensions

Covariance Parameters    7
Columns in X             52
Columns in Z per Subject 4
Subjects                 293
Max Obs per Subject      6

Number of Observations

Number of Observations Read    1794
Number of Observations Used    1724
Number of Observations Not Used 70

Iteration History

Iteration    Evaluations -2 Res Log Like    Criterion
  0           1   12459.91680226
  1           2   11575.67021610   0.00000014
  2           1   11575.66961824   0.00000000

Convergence criteria met.

Covariance Parameter Estimates

Cov Parm    Subject    Group    Estimate
  UN(1,1)    ID         source L  36.0905
### Covariance Parameter Estimates

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### Fit Statistics

- **-2 Res Log Likelihood**: 11575.7
- **AIC (Smaller is Better)**: 11589.7
- **AICC (Smaller is Better)**: 11589.7
- **BIC (Smaller is Better)**: 11615.4

### Null Model Likelihood Ratio Test

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The GLM Procedure

Class Level Information

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Number of Observations Read 299
Number of Observations Used 293

All calves predicted gains full study compare trtmts
The GLM Procedure
Dependent Variable: PredGain

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R-Square  Coeff Var  Root MSE  PredGain Mean
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All calves predicted gains full study compare trtmts
The GLM Procedure
Least Squares Means

Adjustment for Multiple Comparisons: Tukey-Kramer

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Least Squares Means for effect Trtmt
Pr > |t| for H0: LSMean(i)=LSMean(j)
Dependent Variable: PredGain

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All calves predicted gains full study compare trtmts
The Mixed Procedure

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All calves predicted gains full study compare trtmts
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AIC (Smaller is Better) 2114.1
AICC (Smaller is Better) 2114.1
BIC (Smaller is Better) 2117.7

Type 3 Tests of Fixed Effects

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Least Squares Means

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Differences of Least Squares Means

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<th>Estimate</th>
<th>Standard Error</th>
<th>DF</th>
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The GLM Procedure

Class Level Information

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<th>Levels</th>
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<td>24hr ablv abst fenc flap</td>
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Number of Observations Read 299
Number of Observations Used 293

All calves predicted ADG full compare trtmts
The GLM Procedure
Dependent Variable: predADG

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<th>Mean Square</th>
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All calves predicted ADG full compare trtmts

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R-Square  Coeff Var  Root MSE  predADG Mean
0.218411  70.70143  0.222997  0.315406

Source  DF  Type III SS  Mean Square  F Value  Pr > F
Trtmt   4  4.00207811  1.00051953  20.12   <.0001
The GLM Procedure
Least Squares Means

Adjustment for Multiple Comparisons: Tukey-Kramer

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<td>abst</td>
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<td>fenc</td>
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<td>flap</td>
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Least Squares Means for effect Trtmt
Pr > |t| for H0: LSMean(i)=LSMean(j)
Dependent Variable: predADG

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<th>i/j</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<td>2</td>
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<td>&lt;.0001 &lt;.0001</td>
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<tr>
<td>3</td>
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<td>0.0710</td>
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<td>4</td>
<td>0.2081 &lt;.0001</td>
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All calves predicted ADG full compare trtmts
The Mixed Procedure

Model Information

Data Set: AGRON4.ALLGAINQUAD
Dependent Variable: predADG
Covariance Structure: Diagonal
Estimation Method: REML
Residual Variance Method: Profile
Fixed Effects SE Method: Model-Based
Degrees of Freedom Method: Residual

Class Level Information

Class Levels Values
Trtmt 5 24hr abl v abst fenc flap

Dimensions

Covariance Parameters: 1
Columns in X: 6
Columns in Z: 0
Subjects: 1
Max Obs per Subject: 293

Number of Observations

Number of Observations Read: 299
Number of Observations Used: 293
Number of Observations Not Used: 6

Covariance Parameter Estimates

Cov Parm Estimate
Residual 0.04973

All calves predicted ADG full compare trtmts
Fit Statistics
-2 Res Log Likelihood -26.9
AIC (Smaller is Better) -24.9
AICC (Smaller is Better) -24.9
BIC (Smaller is Better) -21.3

Type 3 Tests of Fixed Effects

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<th>Den DF</th>
<th>F Value</th>
<th>Pr &gt; F</th>
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<tbody>
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<td>Trtmt</td>
<td>4</td>
<td>288</td>
<td>20.12</td>
<td>&lt;.0001</td>
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</tbody>
</table>

Least Squares Means

| Effect | Trtmt | Estimate | Standard Error | DF | t Value | Pr > |t| |
|--------|-------|----------|----------------|----|---------|-------|-----|
| Trtmt  | 24hr  | 0.3602   | 0.02665        | 288| 13.51   | <.0001|
| Trtmt  | ablv  | 0.04854  | 0.03666        | 288| 1.32    | 0.1865|
| Trtmt  | abst  | 0.3234   | 0.03617        | 288| 8.94    | <.0001|
| Trtmt  | fenc  | 0.4399   | 0.02610        | 288| 16.85   | <.0001|
| Trtmt  | flap  | 0.2801   | 0.02575        | 288| 10.88   | <.0001|

Differences of Least Squares Means

| Effect | Trtmt | Trtmt | Estimate | Standard Error | DF | t Value | Pr > |t| | Adjustment | Adj P |
|--------|-------|-------|----------|----------------|----|---------|-------|-----|----------------|-------|
| Trtmt  | 24hr  | ablv  | 0.3117   | 0.04533        | 288| 6.88    | <.0001| Tukey-Kramer | <.0001|
| Trtmt  | 24hr  | abst  | 0.03681  | 0.04493        | 288| 0.82    | 0.4134| Tukey-Kramer | 0.9246|
| Trtmt  | 24hr  | fenc  | -0.07965 | 0.03730        | 288| -2.14   | 0.0336| Tukey-Kramer | 0.2081|
| Trtmt  | 24hr  | flap  | 0.08012  | 0.03706        | 288| 2.16    | 0.0314| Tukey-Kramer | 0.1973|
| Trtmt  | ablv  | abst  | -0.2749  | 0.05150        | 288| -5.34   | <.0001| Tukey-Kramer | <.0001|
| Trtmt  | ablv  | fenc  | -0.3913  | 0.04500        | 288| -8.70   | <.0001| Tukey-Kramer | <.0001|
| Trtmt  | ablv  | flap  | -0.2315  | 0.04480        | 288| -5.17   | <.0001| Tukey-Kramer | <.0001|
| Trtmt  | abst  | fenc  | -0.1165  | 0.04461        | 288| -2.61   | 0.0095| Tukey-Kramer | 0.0710|
| Trtmt  | abst  | flap  | 0.04331  | 0.04440        | 288| 0.98    | 0.3302| Tukey-Kramer | 0.8661|
| Trtmt  | fenc  | flap  | 0.1598   | 0.03666        | 288| 4.36    | <.0001| Tukey-Kramer | 0.0002|
Supplemental figure S1: Mean of actual weights of all calves, presented as main treatment groups (no shipment classification). Weaning method designations are different from those used in the manuscript. 24hr is the SEP group, which had 24 hour separation from dam prior to weaning; ablv is AW-I, which were abruptly weaned and immediately shipped; abst is AW-D, which were weaned abruptly but remained at ranch of origin through D28; fenc is fenceline weaned (FL); and flap is nose-flap (NF). Time 1 reflects weaning, with time -2 representing first weight acquisition, upon which assignment to treatment was based; time -1 reflects base weight at time of study initiation (first separation from dam for the SEP group occurred immediately after this weighing); time 0 represents time of second separation for SEP group and placement of nose flaps for NF group; time 2 is D7; time 3 is D14; and time 4 is D28.
Supplemental figure S2: Mean of actual weights of all calves, presented as a single parameter reflecting both main treatment groups and shipment classification (either shipped on D7 [B] or remaining on ranch of origin throughout study [A]). Weaning method designations are different from those used in the manuscript. 24hr is the SEP group, which had 24 hour separation from dam prior to weaning; ablvC is AW-I, which were abruptly weaned and immediately shipped; abstA is AW-D, which were weaned abruptly but remained at ranch of origin through D28; fenc is fenceline weaned (FL); and flap is nose-flap (NF). Time 1 reflects weaning, with time -2 representing first weight acquisition, upon which assignment to treatment was based; time -1 reflects base weight at time of study initiation (first separation from dam for the SEP group occurred immediately after this weighing); time 0 represents time of second separation for SEP group and placement of nose flaps for NF group; time 2 is D7; time 3 is D14; and time 4 is D28.
Supplemental figure S3: Mean of predicted weights of all calves, presented as a single parameter reflecting both main treatment groups and shipment classification (either shipped on D7 [B] or remaining on ranch of origin throughout study [A]). Weaning method designations are different from those used in the manuscript. 24hr is the SEP group, which had 24 hour separation from dam prior to weaning; ablvC is AW-I, which were abruptly weaned and immediately shipped; abstA is AW-D, which were weaned abruptly but remained at ranch of origin through D28; fenc is fenceline weaned (FL); and flap is nose-flap (NF). Time 1 reflects weaning, with time -2 representing first weight acquisition, upon which assignment to treatment was based; time -1 reflects base weight at time of study initiation (first separation from dam for the SEP group occurred immediately after this weighing); time 0 represents time of second separation for SEP group and placement of nose flaps for NF group; time 2 is D7; time 3 is D14; and time 4 is D28.
Supplemental figure S4: Actual weights of calves from location #1, presented as main treatment groups (no shipment classification). Weaning method designations are different from those used in the manuscript. 24hr is the SEP group, which had 24 hour separation from dam prior to weaning; abl is AW-I, which were abruptly weaned and immediately shipped; abst is AW-D, which were weaned abruptly but remained at ranch of origin through D28; fenc is fenceline weaned (FL); and flap is nose-flap (NF). Time points are different from figures 1 and 2. In this figure, time 0 reflects weaning, with time -2 representing base weight at time of study initiation (first separation from dam for the SEP group occurred immediately after this weighing); time -1 represents time of second separation for SEP group and placement of nose flaps for NF group; time 1 is D7; time 2 is D14; and time 3 is D28.
Supplemental figure S5: Actual weights of calves from location #2, presented as main treatment groups (no shipment classification). Weaning method designations are different from those used in the manuscript. 24hr is the SEP group, which had 24 hour separation from dam prior to weaning; ablv is AW-I, which were abruptly weaned and immediately shipped; abst is AW-D, which were weaned abruptly but remained at ranch of origin through D28; fenc is fenceline weaned (FL); and flap is nose-flap (NF). Time points are different from figures 1 and 2. In this figure, time 0 reflects weaning, with time -2 representing base weight at time of study initiation (first separation from dam for the SEP group occurred immediately after this weighing); time -1 represents time of second separation for SEP group and placement of nose flaps for NF group; time 1 is D7; time 2 is D14; and time 3 is D28.