

# NEW YORK POTASSIUM NEEDS FOR ALFALFA: Alfalfa Yield and Quality Response to Potassium On-Farm Field Trial Protocol - 2010

## Overview

The objective of this study is to evaluate two soil testing approaches to K management (Cornell guidelines based on Morgan extractable K and the K saturation ratio approach) for alfalfa in corn-alfalfa rotations, taking into account yield, quality and stand survival. At on-farm locations in northern, eastern, western and southern NY, we will conduct strip-trials in four replications to determine K yield and quality response (0 or 350 lbs/acre of 0-0-60) on 6 fields per farm (6 fields, 8 plots per field for a total of 48 plots per farm). Fields will be selected for the largest possible range of soil test K and percent K saturation within each farm with a minimum of 3 fields in the low or medium ranges for Morgan extractable soil test K. Plots will receive K when the trial is set up right after first cutting, and will be harvested in a 3- to 4-cut system, depending on growing conditions and location. Trials will be conducted over two years with, if funding materializes, stand survival assessment in the third year (3-year project). Soil samples will be taken twice a year, at initial set up of trial plots following 1<sup>st</sup> cutting (prior to applying K fertilizer) and after the final harvest, and analyzed for Morgan K and percent K saturation. Tissue samples will be taken at 3<sup>rd</sup> cutting for nutrient content analysis.

## Field Selection

Try to find:

(1) A willing producer who

- has credibility and a visible/accessible site
- is interested and reliable in his/her communication with you
- will tell you when (s)he will harvest before actually starting the harvest

(2) Alfalfa fields with a wide range of soil test K and percent K saturation within the farm (at least 3 fields should be in low to medium range) that

- are 2<sup>nd</sup> year or later
- will remain in alfalfa 3 more years
- will not receive manure for the 3 years of the study
- have optimum pH (>6.8)

## Plot Design

There will be two treatments in side by side 10 ft by 10 ft plots (forming a 10 ft x 20 ft rectangle; see figure 1):

1. No K
2. +K (350 lb/acre 0-0-60)

Fertilizer is provided in pre-measured amounts for each plot: The +K plot receives 350 lb/acre 0-0-60 (210 lb K<sub>2</sub>O/acre) and both plots receive 110 lb/acre 0-45-0 (50 lb P<sub>2</sub>O<sub>5</sub>/acre) to be sure P is not a limiting factor.

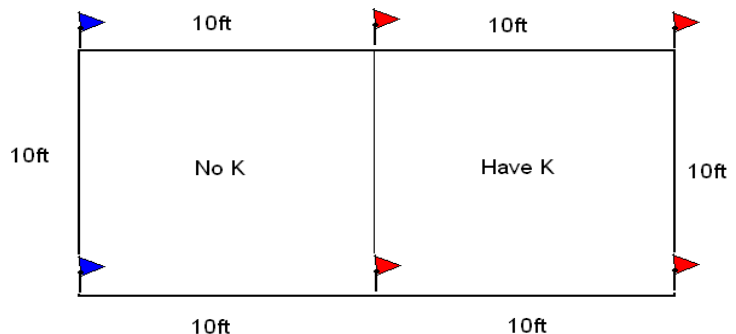


Figure 1. The set-up of a typical research plot with two treatments.

## Initial site set-up

### Equipment needed:

- GPS, site maps or paper for making site maps
- Pen, pencil, fine tip permanent marker
- Camera
- Tape measure (50 or 100 ft)
- Flags, 96 orange and 48 blue
- Wooden stakes 144 (6 per rep x 4 reps x 6 fields)
- Small sledge hammer
- Spray paint, 4 orange and 2 blue
- Tall, white poles 24 (1 per rep)
- Soil probes (1-2)
- Buckets or coffee cans for collecting composite soil samples (1-2)
- Plastic bags for soil samples (96 plus extras)
- Labels (preprinted) on cardstock for soil samples (48)
- Phosphorus fertilizer packets – pre-measured (48 plus 4 extra)
- Potassium fertilizer packets – pre-measured (24 plus 4 extra)

### Laying out plots in field

1. Directly after farmer's first alfalfa harvest, select sites within each study field for the 4 replications of side by side treatment plots based on the following criteria:
  - plot areas should be as level as possible and have an approximately uniform alfalfa population
  - if there is some unavoidable slope, orient the long side of the double plot at right angles to the slope line so that fertilizer treatments will not run off into the paired treatment plot
  - if there are notable tractor traffic patterns in field, try to orient long side of plots parallel to the tractor ruts, but avoid placing +K treatment upslope of No K treatment.

Treatments are replicated 4 times in each field, within a 100 ft by 100 ft area (~50 feet apart, depending on the criteria above). They can be offset from each other if necessary to meet site selection criteria.

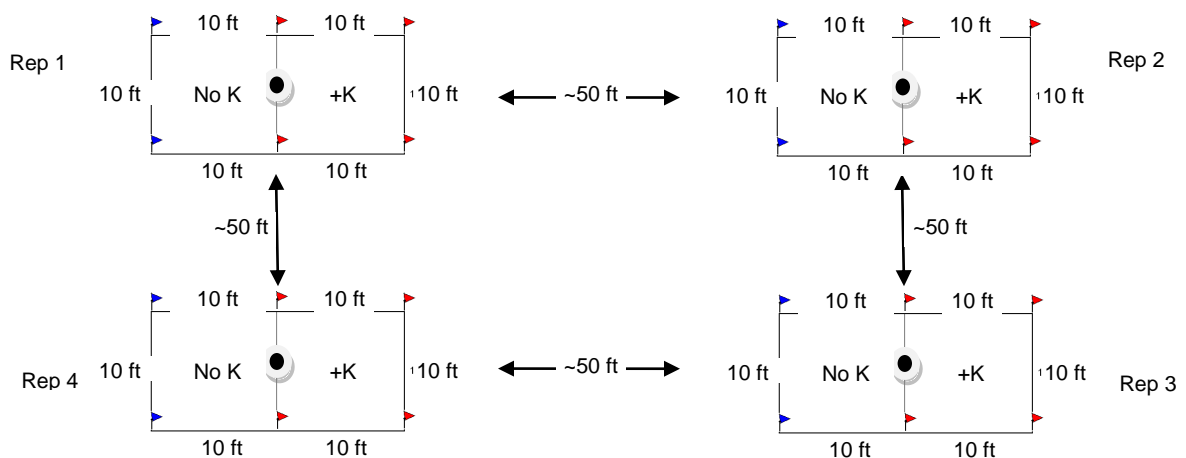


Figure 2. Possible layout of replicated plots in each field. GPS readings at black dots (white pole).

2. Layout and mark plots. First measure and flag the corners of the treatment plots, using blue flags for the outside end of the No K plot and orange flags for the midpoint (shared) and outside corners of the +K plot. Then drive wooden stakes flush to the ground at each flagged corner to of the 10 ft by 10 ft treatment plots. Spray paint the tops of the stakes to identify the treatments: blue on the outside corner of the No K plot and orange on all four corners of the +K plot. The wood markers are used to find plot corners again after farmer harvest of field. Place a single tall, white “fence” post in center of each rep so plot can be found at harvest time when alfalfa is tall.



Figure 3. Looking down length of one 10 ft by 20 ft double plot after initial set up.

### Soil sampling

Take soil samples before fertilizing the plots at initial set-up of the trials (and again at final harvest). There will be 8 soil samples per field (2 treatments x 4 reps); 48 samples total for the 6 fields on the farm.

For each 10x10 ft treatment plot:

- Take one composited soil sample consisting of 8 individual cores (0-8 inches, randomly selected within each plot).
- Place in plastic bag, seal, and enclose in 2<sup>nd</sup> plastic bag along with correct label for the field, rep# and treatment. Collect all bags from each field, freeze until can be transported to NMSP in Morrison Hall for processing and analysis.



### Fertilizer treatments

Two premeasured packets of phosphate fertilizer (0-45-0 triple superphosphate) and one packet of potash (0-0-60 potassium chloride) fertilizer are provided for each replication (double plot). Evenly spread the contents of one pre-weighed packet of the phosphate fertilizer on each 10x10 ft “No K” and 10x10 ft “+K” plot to be sure they are not limited by P. Then evenly apply one of the pre-weighed packets of potash fertilizer to the “+K” plot (the area surrounded by the red flags).

## **Identification of plot locations**

Record location of all plots using two methods:

- (1) Use GPS (Global Positioning System) to record coordinates at white pole (center of double plot).
- (2) On a hand-drawn map of the field prepared on-site, identify permanent landmarks, such as a field entrance driveway or notable tree or building, and pace and record distances with indication of pathway direction to first rep plot and from there to other plot locations.

Once the alfalfa is tall, all of these, plus the tall white marker pole may be necessary to locate some of the plots at harvest time.

## ***Make sure the farmer knows where the plots are!***

### **Harvest I (2<sup>nd</sup> cutting)**

Equipment needed:

- GPS (if available), site maps
- Camera
- Weigh scale/balance
- Data forms for recording weight of harvest samples
- 4 Sampling frames (one for each rep)
- 4 Grass clippers (battery operated), extra charged batteries
- Set of 48 large pre-labeled bags for alfalfa cuttings
- Spray paint (2 cans blue, 3 cans orange)
- Small sledge hammer to pound in any stakes that have popped up

## ***Be sure farmer will give you at least a few days warning about date of his 2<sup>nd</sup> and 3<sup>rd</sup> cuttings.***

Harvest research plots 1 to 2 days before the farmer harvests the fields. A team of 4 works best to carry out the harvest quickly. Each person is assigned a particular rep to cut in all 6 fields. If assigned to rep 3, that means you cut rep 3 at all field sites. Under all conditions, each pair of treatments (the No K and the +K) for a rep should be harvested by the same person to maintain consistency in harvest.

1. Locate the plots using the tools above.
2. Take photos of each rep with both treatments (i.e. colored flags) captured in the picture frame for visual comparison. Consistency of sequence of reps photographed from field to field (so always rep 1, then 2, then 3, then 4) and writing down the sequence of fields will make it easy to identify plots and treatments later. Record field and rep names with the picture at the end of the harvest to avoid confusion later on.
3. Alfalfa harvest: Slide open end of sampling frame into grass at a slight angle, allowing the frame to part the grasses along length of frame. Manually clean up along frame edges so that alfalfa and grasses rooted inside the frame are standing inside the frame and alfalfa and grasses rooted outside are all outside the frame. Using the battery operated grass shears, grab handfuls of alfalfa mixture (including weeds and grasses) and harvest everything that is within the frame using the top of the frame as cutting height guide (4 inches above ground) and place cuttings in the appropriately labeled grocery bag for that rep# and treatment. Move frame and cut 2 more subsamples from each plot as illustrated

in figure 3 and combine the 3 samples from the first treatment in the same bag. Repeat in the other 10x10 ft plot, using correctly labeled new bag for the second treatment. Fold over tops of sample bags, take to where scale has been set up to record wet weight of samples before leaving the field.

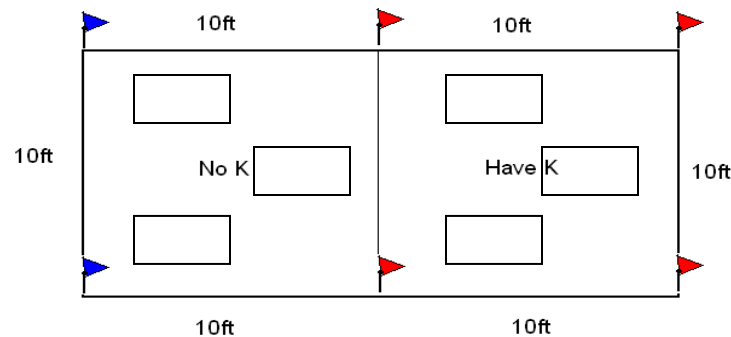


Figure 3. Placement of sampling frame for harvest of 3 composite samples from each plot. Align the frames in the same lengthwise line as much as possible so that they align similarly with any tractor patterns. However, make adjustments in frame placement as necessary to avoid bare or particularly weedy patches, aiming for representative samples.

4. Repaint tops of wooden stake markers.
5. Remove all flags and poles (in preparation for farmer machine harvest).
6. Weigh the samples: Level and calibrate the scale. An empty bag can be used to calibrate and record a tare weight to subtract for the bags. Weigh bags one at a time, recording the weights in the “Fresh+bag” column for correctly matched Rep# and treatment (“Have K” or “No K”) on the “K Management Research Alfalfa Harvest Sheet.” Be sure to fill out which cutting it is (2<sup>nd</sup>, 3<sup>rd</sup>, or 4<sup>th</sup>), Farm or Farmer’s name, Field Number, Date, and Operator (person weighing bags) at top of form.
7. Bagged samples and data sheet go to NMSP at Cornell for processing and analysis.

#### **Re-mark plots with paint, flags and poles**

- Return to fields *within a few days after farmer harvest* to relocate and reflag plots.

#### **Harvest II (3rd cutting) – Same as Harvest I, plus tissue sampling**

*Equipment needed as listed above plus:*

- Scissors (1 pair)
- Small (lunch-sized) pre-labeled paper bags for tissue quality samples (48)
- Knife and cutting board with 6” marker for cutting tissue samples to length

Follow **Harvest I** steps 1 through 7, adding step 3b (below) to the alfalfa harvest before removing flags:

- 3b. Collect sample for tissue analysis: Hand collect a subsample of 30-35 alfalfa shoots at approximately six randomly selected sites within each plot, cutting long stems with the scissors. Align the tips of the stems, set on cutting board and, measuring 6 inches from the tips, slice across stems with knife and place the 6-inch tips in small paper bag labeled for the corresponding rep# and plot treatment. Fold down top of bag to close. There will be one subsample bag per plot to be analyzed for tissue K Best if same person does this for all reps and plots.

#### **Re-mark plots with paint, flags and poles**

- Return to fields *within a few days after farmer harvest* to relocate and reflag plots.

**Final harvest (usually 4th cutting) – Same as Harvest I, plus soil sampling**

*Equipment needed as listed for Harvest I plus:*

- Soil sample probes (1-2)
- Buckets or coffee cans to hold open plastic bag for soil samples (1-2)
- Plastic bags for soil samples (96+)
- Preprinted labels on cardstock for soil samples (48)

Follow **Harvest I** steps 1 through 7 above, plus

3.b Collect soil samples from each plot (before removing flags): For each 10x10 ft treatment plot, as described on page 3, take one composited soil sample consisting of 8 cores (0-8 inches, randomly selected within each plot). Place in plastic bag, seal, and enclose in 2<sup>nd</sup> plastic bag along with correct label for the field, rep# and treatment.

**Store flags, poles, equipment for 2<sup>nd</sup> year of study in 2011.**

**2011 season:**

If possible, return to fields early in spring to locate and repaint wooden stakes before alfalfa grows.





Date:

### K Mangement Research Alfalfa Harvest Sheet ( cutting)

Farmer's Name:		Farmer field Name:				NMSP Field #:			Unit: grams		
<b>Rep 1</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep1 Fresh											
Rep1 Dry											
<b>Rep 2</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep2 Fresh											
Rep2 Dry											
<b>Rep 3</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep3 Fresh											
Rep3 Dry											
<b>Rep 4</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep4 Fresh											
Rep4 Dry											





Date:

### K Mangement Research Alfalfa Harvest Sheet ( cutting)

Farmer's Name:		Farmer field Name:				NMSP Field #:			Unit: grams		
<b>Rep 1</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep1 Fresh											
Rep1 Dry											
<b>Rep 2</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep2 Fresh											
Rep2 Dry											
<b>Rep 3</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep3 Fresh											
Rep3 Dry											
<b>Rep 4</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep4 Fresh											
Rep4 Dry											



Date:

### K Mangement Research Alfalfa Harvest Sheet ( cutting)

Farmer's Name:		Farmer field Name:				NMSP Field #:			Unit: grams		
<b>Rep 1</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep1 Fresh											
Rep1 Dry											
<b>Rep 2</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep2 Fresh											
Rep2 Dry											
<b>Rep 3</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep3 Fresh											
Rep3 Dry											
<b>Rep 4</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep4 Fresh											
Rep4 Dry											



Date:

### K Mangement Research Alfalfa Harvest Sheet ( cutting)

Farmer's Name:		Farmer field Name:				NMSP Field #:			Unit: grams		
<b>Rep 1</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep1 Fresh											
Rep1 Dry											
<b>Rep 2</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep2 Fresh											
Rep2 Dry											
<b>Rep 3</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep3 Fresh											
Rep3 Dry											
<b>Rep 4</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep4 Fresh											
Rep4 Dry											



Date:

### K Mangement Research Alfalfa Harvest Sheet ( cutting)

Farmer's Name:		Farmer field Name:				NMSP Field #:			Unit: grams		
<b>Rep 1</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep1 Fresh											
Rep1 Dry											
<b>Rep 2</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep2 Fresh											
Rep2 Dry											
<b>Rep 3</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep3 Fresh											
Rep3 Dry											
<b>Rep 4</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep4 Fresh											
Rep4 Dry											



Date:

### K Mangement Research Alfalfa Harvest Sheet ( cutting)

Farmer's Name:		Farmer field Name:				NMSP Field #:			Unit: grams		
<b>Rep 1</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep1 Fresh											
Rep1 Dry											
<b>Rep 2</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep2 Fresh											
Rep2 Dry											
<b>Rep 3</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep3 Fresh											
Rep3 Dry											
<b>Rep 4</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep4 Fresh											
Rep4 Dry											



Date:

### K Mangement Research Alfalfa Harvest Sheet ( cutting)

Farmer's Name:		Farmer field Name:				NMSP Field #:			Unit: grams		
<b>Rep 1</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep1 Fresh											
Rep1 Dry											
<b>Rep 2</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep2 Fresh											
Rep2 Dry											
<b>Rep 3</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep3 Fresh											
Rep3 Dry											
<b>Rep 4</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep4 Fresh											
Rep4 Dry											



Date:

### ***K Mangement Research Alfalfa Harvest Sheet ( cutting)***

Farmer's Name:		Farmer field Name:				NMSP Field #:			Unit: grams		
<b>Rep 1</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep1 Fresh											
Rep1 Dry											
<b>Rep 2</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep2 Fresh											
Rep2 Dry											
<b>Rep 3</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep3 Fresh											
Rep3 Dry											
<b>Rep 4</b>						<b>Operator:</b>					
Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry	Lab ID:	Fresh+bag	Fresh	Tray	Tray+dry	Dry
Have K						No K					
Rep4 Fresh											
Rep4 Dry											