SURVEY OF FUSARIUM INFECTED POTATO SEED

Andrew Hollingshead

Introduction

- Potatoes are a major crop in Southern Idaho
- Seed is obtained from many different sources
- There is a lot of risk involved with buying seed

Introduction

- Certified seed limits the amount of fungal and viral disease
  - less risk
- *Fusarium sambucinum* causes dry rot while seed is in storage
- It infects through wounds and can greatly decrease the amount of seed
- Tolerance levels are about 5%

Introduction

- Kimberly Research and Extension plants potato seed every year for research
- Dry rot can decrease plant emergence
- We wanted to know the proportion of dry rot in our seed pieces
- Does the amount found meet Certified seed standards?

Sampling Design

- The population is the total amount of seed pieces obtained for research
- Elements
  - If the seed pieces are diseased or not
- Frame- all seed pieces of the 4 varieties
  - Bannock Russet, Clearwater Russet, Ranger Russet, Umatilla Russet
- Sampling units
  - Seed pieces of the 4 varieties
- Sample
  - 74 total seed pieces

Sampling Design

- Sampling methods included
  - Simple Random Sample
  - Systematic Random sample
  - Stratified Random Sample
- Chose to use Stratified random sampling because there would most likely be large variability between varieties
- Used Varieties as strata

Methods

- Counted out how many total seed pieces we received from growers
- Using a bound of 5% allocation of strata were determined
- Total sample size of 74
- Results were determined using R statistical package

Variety	Total number of seed pieces	Allocation	Allocated sample size
Bannock	494	0.24	18
Clearwater	535	0.26	19
Ranger	307	0.15	11
Umatilla	720	0.35	26

Methods

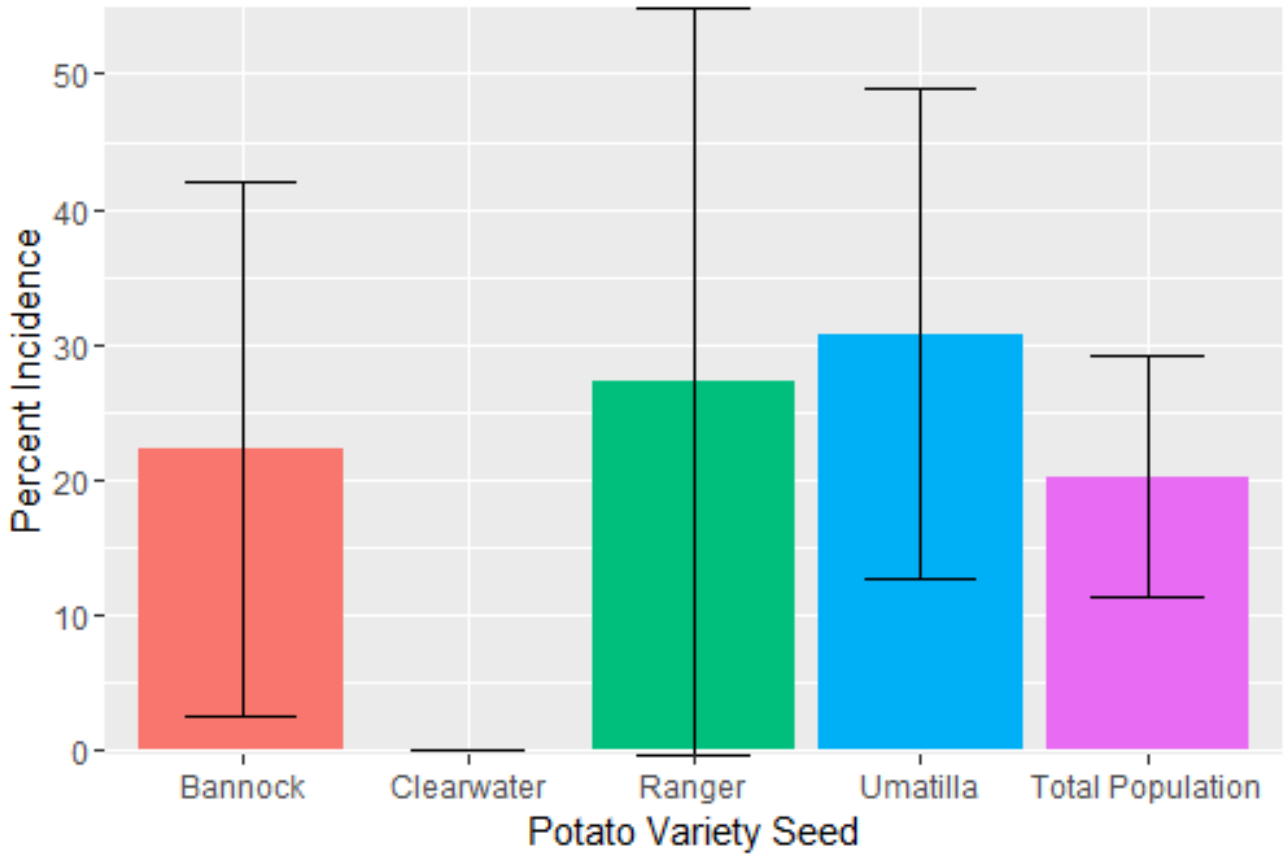
- Seed pieces were randomly selected by grabbing seed without looking
- As seed pieces were dumped onto table I grabbed the tubers without looking at them and varied the time I grabbed them.
- The amount of seed pieces were selected based on the knowledge that only 5% of population should be infected with fusarium

Variable	Value
σ	0.0125
D	$6.25\ e^{-6}$
B	0.5%

```
nrana=(307*sqrt(.05*.95))/sum(Ttub*sqrt(.05*.95))
numaa=(720*sqrt(.05*.95))/sum(Ttub*sqrt(.05*.95))

ai=c(nbana,nClwa,nrana,numaa)
n=sum((Ttub^2)*((.05*.95)/ai))/((2056^2)*0.000625+sum(Ttub*.05*.95))

sample=round(n*ai,digits=0)
ai

setwd("C:/Users/akhollingshead/Desktop/seed project")
fusinc <- read.csv("C:/Users/akhollingshead/Desktop/seed project/fusinc.csv")
attach(fusinc)
stinc=c(4,0,3,8)
pi=c(stinc/sample,pst)

pst=(1/2056)*sum(Ttub*pi)
Vpst=(1/(2056^2))*sum((Ttub^2)*((pi*(1-pi))/(sample-1))*((Ttub-sample)/Ttub))
B=2*sqrt(Vpst)
pi
variance=c(((.2222222*(1-.2222222))/17)*((494-18)/494),0,((0.2727273*(1-0.2727273))/10)*((307-1
          ((0.3076923*(1-0.3076923))/25)*((720-26)/720),Vpst)
Bt=2*sqrt(variance)

Finc <- data.frame(variety,pi,Bt)
Finc$pi=Finc$pi*100
Finc$Bt=Finc$Bt*100
str(Finc)

Finc$variety <- factor(Finc$variety, levels=c("Bannock","Clearwater","Ranger","Umatilla","Total
plot1=ggplot(Finc, aes(variety, pi, fill=variety))
plot1+geom_bar(stat="identity")+geom_errorbar(aes(variety,ymax=pi+Bt, ymin=pi-Bt), size=.5,widt
  theme(legend.position="none")+scale_y_continuous(expand = c(0, 0))+
  ylab("Percent Incidence")+xlab("Potato Variety Seed")
```

Analysis

- Bars are the estimated proportions of incidence within the strata
- Total Population is the estimated proportion of the population (20.2%)
- Error bars represent 95% confidence intervals



Analysis

- Proportion of seed pieces in the entire population was about 20.2% ± 8.9%
- The proportions of each potato variety varied
  - Bannock = 22.22%
  - Clearwater = 0%
  - Ranger = 27.3%
  - Umatilla = 30.8%
- Bounds of each were high and over 18% except for Clearwater (0%)

Conclusion

- The Kimberly Research and Extension center received seed with high proportions of Fusarium Dry Rot present
- There was Dry Rot found in Clearwater variety which also indicates a need for a larger sample
- The population bound is to high so next time a larger sample should be taken
- Reason for such a high bound might be due to small sample size but also sampling technique
- In future research I should use a true random number table to obtain randomly selected seed or perform a systematic sample