

Zooming in on 2019 Performance

The key areas recommended to be looked at in this test are the following:

- 1) Using data collected in Ghana at the end of Y2019 cropping season, calculate summary metrics that can inform our Research Team about product performance.
- 2) Present this information in a synthetic and visual manner (you might be asked to go over some of these findings orally during our final interview) Some sample questions that are of particular interest:
 1. Do crop yields (in kg/acre) vary significantly from region to region, from district to district, from farmer to farmer? What seems to be a normal, vs. low, vs. high yield for maize in Ghana?
 2. Do other factors seem to influence crop yields, such as a farmer's gender, literacy, phone ownership, farm size, use of fertilizer, proximity to a larger town, etc.?
 3. Out of the survey sample (cryield table), what is the proportion of farmers who reported bad/good crop yields and received (or did not receive) an insurance payout?
 4. At the district level, can we say that districts with poorer (or better) harvests received higher (or lower) insurance payout amounts?
 5. Can we trust the quality of our Y2019 sampled data?

We first have to install and load the libraries that we are going to need for this analysis.

```
## Loading required package: tidyverse
```

```
## -- Attaching packages -----
```

```
## v ggplot2 3.1.1      v purrr   0.3.2
## v tibble  2.1.1      v dplyr  0.8.0.1
## v tidyr   0.8.3      v stringr 1.4.0
## v readr   1.3.1      v forcats 0.4.0
```

```
## -- Conflicts -----
```

```
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()
```

```
tidy
```

Next step is to read all the data into R using the `read_csv` function from the `readr` package.

We then merge the data into one big dataset so that we can start to explore the data. We discover this relationships by looking at the variables that are shared across the tables.

The resulting table has the following features.

```
## Classes 'spec_tbl_df', 'tbl_df', 'tbl' and 'data.frame': 328 obs. of  60 variables:
## $ cust_id.x      : num  202802 206328 206340 206378 205665 ...
## $ cntr_id        : num  50339 49794 49809 49919 47411 ...
## $ weight         : num  0.5 0.153 0.153 0.153 0.153 ...
## $ strata         : num  1 2 2 2 2 2 2 2 2 2 ...
## $ treatment      : chr   "grp_msg" "grp_none" "grp_none" "grp_none" ...
## $ caller         : chr   "Hurmat" "Hurmat" "Hurmat" "Hurmat" ...
## $ date_called    : Date, format: "2019-12-31" "2019-12-31" ...
## $ call_status    : chr   "connected" "connected" "failed" "connected" ...
## $ planted_acres  : num  3 3 NA NA 2 3 4 2.5 NA NA ...
## $ yield_bags     : num  6 NA NA 1.5 8 4.5 12 9 NA NA ...
## $ fert_bags      : num  8 0 NA 0 0 9 7 3 NA NA ...
## $ yield_rate     : chr   "very poor" "good" NA "good" ...
## $ yield_lost     : chr   "3/4" "none" NA "none" ...
## $ reason         : chr   "drought before flowering" "other" NA "other" ...
## $ yield_max_bags : num  45 20 NA 6 18 45 64 20 NA NA ...
## $ sold_bags      : num  6 0 NA 0 5 2 10 9 NA NA ...
```

```

## $ sold_price      : num  130 0 NA 0 110 120 100 150 NA NA ...
## $ notes           : chr   "Four days after the fertilizer application, the rain stopped , so the ma
## $ call_count      : num   216 95 11 1 2 NA NA NA NA NA ...
## $ date_reg.x       : Date, format: "2018-09-06" "2019-03-22" ...
## $ gender          : chr    "F" "M" NA "M" ...
## $ literacy         : chr    NA NA NA NA ...
## $ farm_size        : num    NA NA NA NA NA NA NA NA NA NA ...
## $ num_parcels      : num    NA NA NA NA NA NA NA NA NA NA ...
## $ cht_season       : chr    "Y2018S2" "Y2019S2" "Y2019S1" "Y2019S1" ...
## $ cht_channel      : chr    "CALL CENTER" "CALL CENTER" "CALL CENTER" "CALL CENTER" ...
## $ cht_phone        : logi    TRUE TRUE TRUE TRUE TRUE TRUE ...
## $ has_mobile_money : logi    TRUE TRUE NA TRUE TRUE TRUE ...
## $ ussd_created     : logi    FALSE FALSE FALSE FALSE FALSE ...
## $ type             : chr    "Ambassador" "Ambassador" "Customer" "Customer" ...
## $ amount_usd.x     : num    7.554 3.777 3.777 3.777 0.944 ...
## $ cust_id.y        : num    202802 206328 206340 206378 205665 ...
## $ status           : chr    "pending" "expired" "pending" "expired" ...
## $ season           : chr    "Y2019S2" "Y2019S2" "Y2019S1" "Y2019S1" ...
## $ product_code     : chr    "MAIZ-GHA-20-ST01" "MAIZ-GHA-20-ST01" "MAIZ-GHA-20-ST01" "MAIZ-GHA-20-ST01"
## $ date_issued      : Date, format: "2019-06-19" "2019-03-22" ...
## $ amount           : num    0 20 20 20 5 40 60 30 20 20 ...
## $ amount_usd.y     : num    0 3.777 3.777 3.777 0.944 ...
## $ date_planted     : Date, format: NA "2019-09-10" ...
## $ date_planted_imp : Date, format: NA "2019-09-10" ...
## $ date_planted_in  : Date, format: NA "2019-09-30" ...
## $ loc_id           : num    4266 1437 1437 1437 4047 ...
## $ payout           : num    NA 0 NA 0 0 0 0 0 0 ...
## $ payout_usd       : num    NA 0 NA 0 0 0 0 0 0 ...
## $ mm_paid          : logi    NA NA NA NA NA NA ...
## $ loc_nm           : chr    "Atonsugya-Grumaline" "Mankranso" "Mankranso" "Mankranso" ...
## $ date_reg.y       : POSIXct, format: "1970-01-01 04:59:58" "1970-01-01 05:00:25" ...
## $ cust_N           : logi    NA NA NA NA NA NA ...
## $ visit_N          : logi    NA NA NA NA NA NA ...
## $ is_female        : logi    NA NA NA NA NA NA ...
## $ channel_zm        : logi    NA NA NA NA NA NA ...
## $ amount_usd       : num    143.5 121.8 121.8 121.8 23.6 ...
## $ ca_nm            : logi    NA NA NA NA NA NA ...
## $ iso3             : chr    "GH(S)" "GH(S)" "GH(S)" "GH(S)" ...
## $ country          : chr    "Ghana" "Ghana" "Ghana" "Ghana" ...
## $ reg_nm           : chr    "GH-AH" "GH-AH" "GH-AH" "GH-AH" ...
## $ dist_id          : num    3936 4559 4559 4559 3936 ...
## $ dist_nm          : chr    "Ejura-Sekyedumase" "Ahafo Ano South" "Ahafo Ano South" "Ahafo Ano South"
## $ X                : num    -1.42 -1.86 -1.86 -1.86 -1.34 ...
## $ Y                : num    7.26 6.82 6.82 6.82 7.41 ...

```

The readme file shared additional information on the weight of bags of different products that we can now use to standardize the measurements of the harvests.

```

## [1] "MAIZ-GHA-20-ST01" "RICE-GHA-20-ST01" "GROU-GHA-20-ST01"
## [4] "SORG-GHA-20-ST01"

```

Below is a computation of the kg values of the bags harvested. This should assist in calculating the yield per hectare.

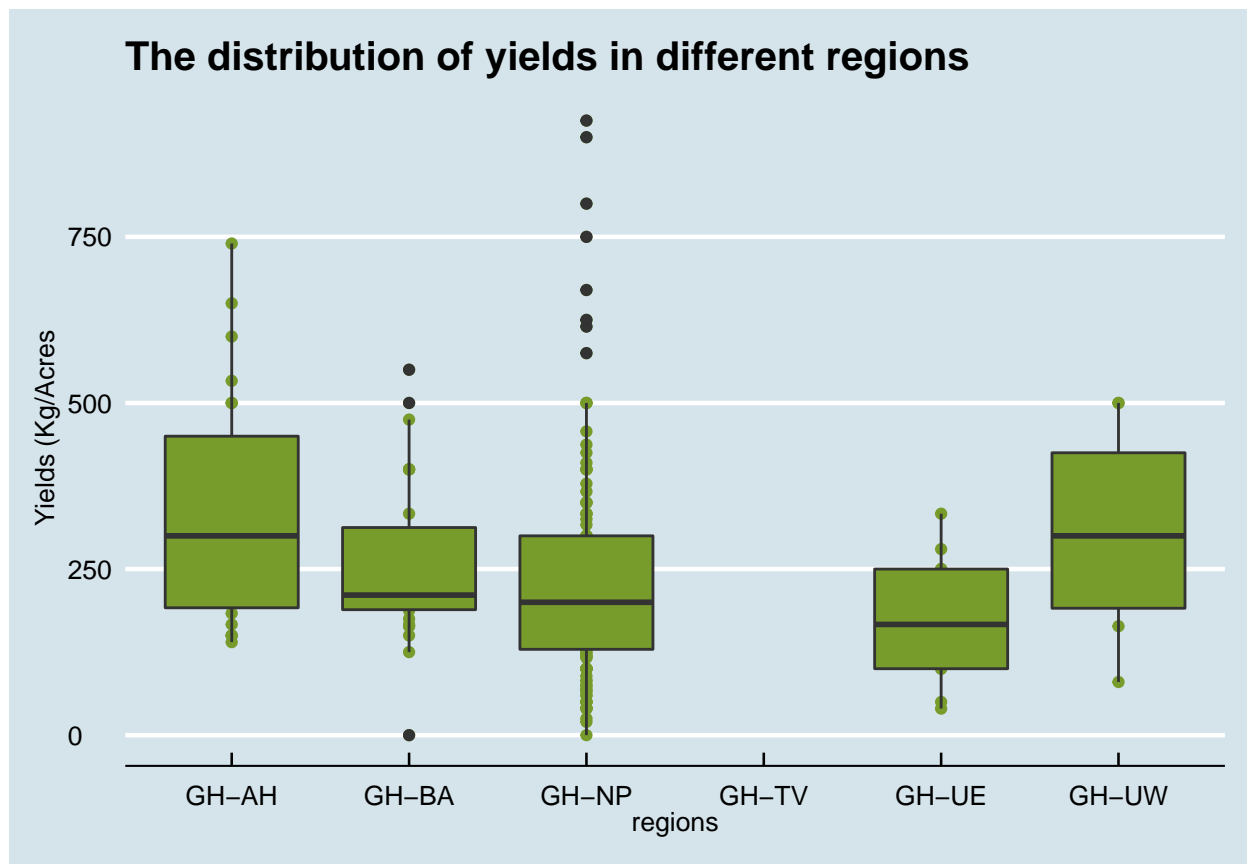
```

## # A tibble: 10 x 5
##   product_code   yield_bags yield_kgs planted_acres kg_acres

```

```
##      <chr>                <dbl>    <dbl>          <dbl>    <dbl>
## 1 MAIZ-GHA-20-ST01         10      1000           4      250
## 2 MAIZ-GHA-20-ST01         NA        NA           NA        NA
## 3 MAIZ-GHA-20-ST01         NA        NA           NA        NA
## 4 RICE-GHA-20-ST01         NA        NA           NA        NA
## 5 RICE-GHA-20-ST01         NA        NA           NA        NA
## 6 GROU-GHA-20-ST01         NA        NA           NA        NA
## 7 MAIZ-GHA-20-ST01         6        600           2      300
## 8 MAIZ-GHA-20-ST01        37      3700           5      740
## 9 RICE-GHA-20-ST01         NA        NA           NA        NA
## 10 MAIZ-GHA-20-ST01        11      1100           2      550
```

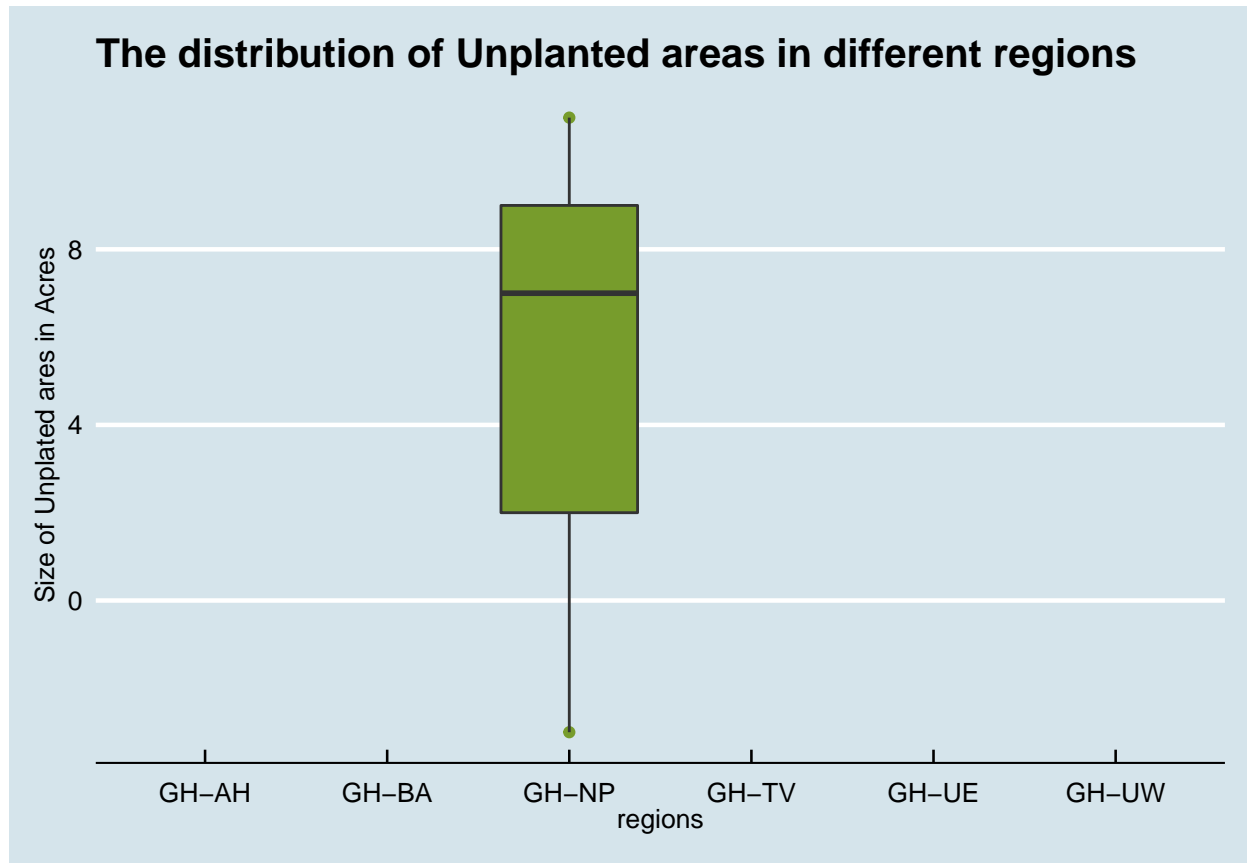
Let's Explore



```
## # A tibble: 6 x 4
##   region district      cust_id.x kg_acres
##   <fct>   <fct>          <dbl>    <dbl>
## 1 GH-AH  Ejura-Sekyedumase  202802    200
## 2 GH-AH  Ahafo Ano South      206328     NA
## 3 GH-AH  Ahafo Ano South      206340     NA
## 4 GH-AH  Ahafo Ano South      206378     NA
## 5 GH-AH  Ejura-Sekyedumase  205665    400
## 6 GH-AH  Ejura-Sekyedumase  205154    150
```

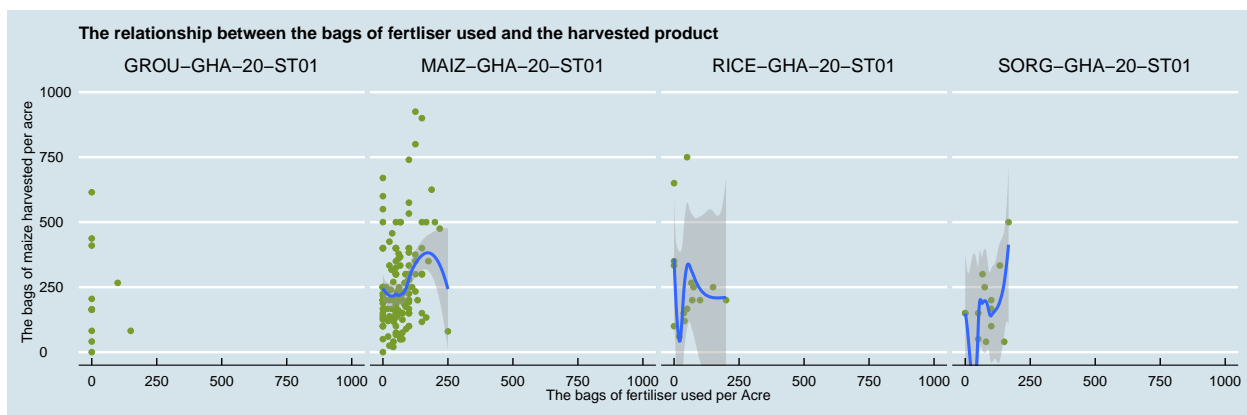
The harvests (in yields/kg) shows that GH-AH and GH-UW are the best with GH-UW having a better harvest distribution as shown by the boxplot above. Additionally, GH-NP seems to have the greatest number

of outliers. GH-UE has the worst harvest of all the other regions that were surveyed.

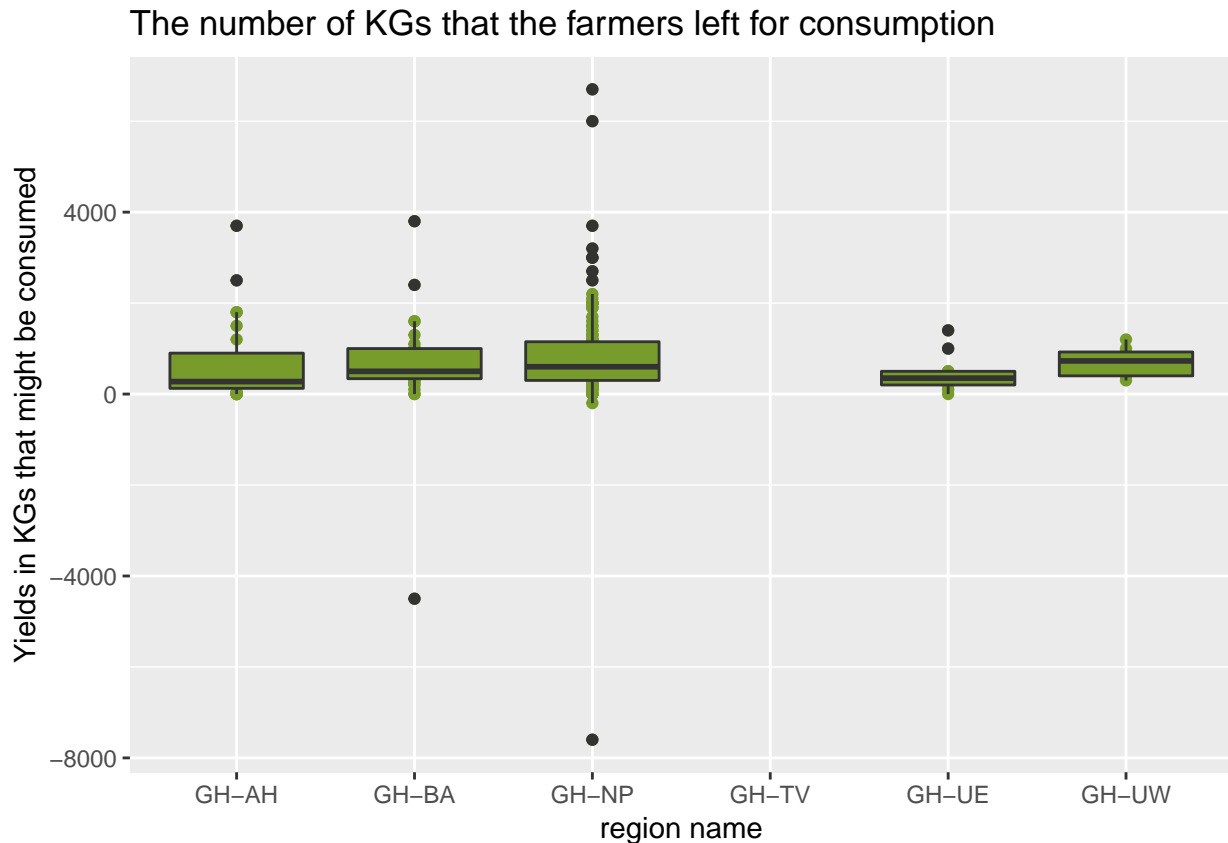


GH-NP is the only region where some farmers did not plant on the full farm with the median farm size left unplanted being 7 Acres. Additionally, there are a farmer who underreported their farm size. This could be a case of data integrity and is worthy of a closer look to determine the scale across WC database.

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```



Fertiliser use (assuming 50kg is the standard bag of fertiliser) seems to influence the harvest proportion with the maximum rate being about 200kgs/acre. Of all the crops, Sorghum seems to respond the best to fertiliser application.



In GH-BA and GH-NP there are some farmers who seem to have misrepresented their harvest data. Investigation should reveal whether this deserves more attention or not.

Now that we have a better understanding of the harvest performance we can start to look at answering the questions posed.

1. Do crop yields (in kg/acre) vary significantly from region to region, from district to district, from farmer to farmer? What seems to be a normal, vs. low, vs. high yield for maize in Ghana?

Region to Region

```
##
## Call:
## lm(formula = kg_acres ~ region, data = surveysubset)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -256.00 -102.49  -35.83   69.81  689.17
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    338.33     33.87   9.988 < 2e-16 ***
## regionGH-BA    -82.33     45.02  -1.829  0.06896 .
## regionGH-NP   -102.51     36.73  -2.791  0.00577 **
## regionGH-UE   -163.79     59.55  -2.750  0.00651 **
## regionGH-UW    -32.83     66.68  -0.492  0.62299
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 162.5 on 198 degrees of freedom
## (125 observations deleted due to missingness)
## Multiple R-squared:  0.05329,    Adjusted R-squared:  0.03416
## F-statistic: 2.786 on 4 and 198 DF,  p-value: 0.02775
```

There's some evidence of varying yields in all regions except GH-UW and across regions with a p-value of 0.02 we can assume variation of yields across regions. Our F-score at 2.7 confirms this as shown below.

```
## Analysis of Variance Table
##
## Response: kg_acres
##           Df Sum Sq Mean Sq F value Pr(>F)
## region      4  294127   73532   2.7862 0.02775 *
## Residuals 198 5225586   26392
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The anova test confirms this significant variation between groups in different regions.

District to District

```
##
## Call:
## lm(formula = kg_acres ~ district, data = surveysubset)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -237.92 -103.75  -16.67   56.95  726.11
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      291.204     55.292   5.267 4.13e-07 ***
## districtBongo     -194.537    110.584  -1.759  0.0803 .
## districtBunkpurugu Yonyo    -38.870     76.215  -0.510  0.6107
## districtCentral Gonja     -92.316     74.556  -1.238  0.2173
## districtChereponi       58.796    174.849   0.336  0.7371
## districtEast Gonja     -18.426     87.424  -0.211  0.8333
## districtEast Mamprusi    -73.426    110.584  -0.664  0.5076
## districtEjura-Sekyedumase  47.130     65.219   0.723  0.4709
## districtGushiegu     -59.870     68.379  -0.876  0.3825
## districtKaraga       -76.442     87.424  -0.874  0.3831
## districtKassena Nankana West -87.454     80.601  -1.085  0.2794
## districtKpandai     -174.537    129.671  -1.346  0.1801
## districtKumbungu     -66.918     83.594  -0.801  0.4245
## districtMamprugu Moaduri   -41.204    110.584  -0.373  0.7099
## districtMion         21.225     92.521   0.229  0.8188
## districtNandom       21.596     92.521   0.233  0.8157
## districtNanumba North  -149.870    110.584  -1.355  0.1771
## districtNanumba South  -191.204    174.849  -1.094  0.2757
## districtPru         -74.537    110.584  -0.674  0.5012
## districtSagnarigu     108.796    129.671   0.839  0.4026
## districtSavelugu-Nanton  -28.288     63.293  -0.447  0.6555
## districtSawla-Tuna-Kalba -124.870     99.679  -1.253  0.2120
```

```
## districtSene East      -80.815      73.144   -1.105   0.2708
## districtSene West      22.884      87.424    0.262   0.7938
## districtSissala West   -211.204     174.849   -1.208   0.2287
## districtTamale Metropolitan 12.963      80.601    0.161   0.8724
## districtTolon         -112.037      99.679   -1.124   0.2626
## districtWa East        208.796     174.849    1.194   0.2341
## districtWa West         8.796     174.849    0.050   0.9599
## districtWest Mamprusi   -141.204     174.849   -0.808   0.4205
## districtYendi Municipal -141.204      92.521   -1.526   0.1288
## districtZabzugu        -110.704     110.584   -1.001   0.3182
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 165.9 on 171 degrees of freedom
## (125 observations deleted due to missingness)
## Multiple R-squared:  0.1476, Adjusted R-squared:  -0.006938
## F-statistic: 0.9551 on 31 and 171 DF,  p-value: 0.5402

## Analysis of Variance Table
##
## Response: kg_acres
##           Df Sum Sq Mean Sq F value Pr(>F)
## district   31  814668    26280  0.9551 0.5402
## Residuals 171 4705044    27515
```

There's little to no evidence in this data that confirm variation between the yields from one district to another. This is because we have an F-score less than 1 and a p-value greater than 0.05

Customer to Customer

```
##
## Call:
## lm(formula = kg_acres ~ cust_id.x, data = surveysubset)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -257.09 -110.22  -46.99   87.02  686.92
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 2.107e+02  2.868e+01  7.347 4.98e-12 ***
## cust_id.x    2.461e-04  1.652e-04  1.490   0.138
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 164.8 on 201 degrees of freedom
## (125 observations deleted due to missingness)
## Multiple R-squared:  0.01092, Adjusted R-squared:  0.006004
## F-statistic: 2.22 on 1 and 201 DF,  p-value: 0.1378

## Analysis of Variance Table
##
## Response: kg_acres
##           Df Sum Sq Mean Sq F value Pr(>F)
## cust_id.x   1   60303    60303  2.2202 0.1378
```

```
## Residuals 201 5459410 27161
```

There's no evidence of variation of yields from customer to customer that can be confirmed with this survey.

Normal vs High Yield vs Low Yield

```
## Tukey multiple comparisons of means
## 95% family-wise confidence level
##
## Fit: aov(formula = kg_acres ~ region, data = surveysubset)
##
## $region
##          diff          lwr          upr      p adj
## GH-BA-GH-AH -82.33254 -206.28839  41.6233152 0.3600739
## GH-NP-GH-AH -102.50734 -203.62207 -1.3925998 0.0451625
## GH-UE-GH-AH -163.78788 -327.74597  0.1702123 0.0503819
## GH-UW-GH-AH -32.83333 -216.41343 150.7467619 0.9880011
## GH-NP-GH-BA -20.17480 -110.70017  70.3505764 0.9728159
## GH-UE-GH-BA -81.45534 -239.10339  76.1927148 0.6139183
## GH-UW-GH-BA  49.49921 -128.46794 227.4663512 0.9400952
## GH-UE-GH-NP -61.28054 -201.68013  79.1190458 0.7504448
## GH-UW-GH-NP  69.67400 -93.21074 232.5587478 0.7641701
## GH-UW-GH-UE 130.95455 -76.86631 338.7753969 0.4150850
```

2. Do other factors seem to influence crop yields, such as a farmer's gender, literacy, phone ownership, farm size, use of fertilizer, proximity to a larger town, etc.?

```
##
## Call:
## lm(formula = kg_acres ~ ., data = yieldfactors)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -511.84  -88.77  -31.83   80.36  663.58
##
## Coefficients: (1 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.068e+03  9.281e+02   1.151 0.251970
## cust_id.x       1.675e-04  3.842e-04   0.436 0.663676
## fert_bags       8.087e+00  2.077e+00   3.895 0.000163 ***
## genderM         6.070e+00  3.479e+01   0.174 0.861777
## literacynone    2.429e+01  8.770e+01   0.277 0.782268
## farm_size      -5.099e-01  2.209e+01  -0.023 0.981619
## num_parcel      -3.072e+01  1.375e+02  -0.223 0.823578
## cht_seasonY2017S1  1.995e+00  9.801e+01   0.020 0.983791
## cht_seasonY2018S1 -2.019e+01  1.060e+02  -0.190 0.849285
## cht_seasonY2018S2  1.412e+02  1.428e+02   0.989 0.324837
## cht_seasonY2019S1 -6.789e+00  1.365e+02  -0.050 0.960420
## cht_seasonY2019S2  1.606e+02  1.608e+02   0.999 0.319774
## cht_seasonY2020S1 -1.258e+02  2.872e+02  -0.438 0.662144
## cht_channelUSSD   -5.823e+01  1.813e+02  -0.321 0.748601
## cht_channelUSSD (CA) -8.605e+01  7.968e+01  -1.080 0.282383
## cht_channelVISIT  -3.613e+01  7.681e+01  -0.470 0.638946
## cht_channelZM/CA  -7.009e+01  9.977e+01  -0.703 0.483703
```



```
## seasonY2019S2      -6.784e+01  6.829e+01 -0.993 0.322498
## seasonY2020S1      NA          NA      NA      NA
## typeCustomer      -8.258e+01  3.931e+01 -2.101 0.037745 *
## loc_id            -9.564e-04  1.593e-02 -0.060 0.952216
## has_mobile_moneyTRUE 2.996e+01  4.500e+01  0.666 0.506859
## reg_nmGH-BA        -2.936e+02  2.808e+02 -1.046 0.297866
## reg_nmGH-NP        -8.898e+02  9.175e+02 -0.970 0.334107
## reg_nmGH-TV        -1.310e+02  1.894e+02 -0.692 0.490502
## reg_nmGH-UE        -7.342e+02  9.230e+02 -0.795 0.427916
## reg_nmGH-UW        -8.807e+02  9.112e+02 -0.967 0.335750
## dist_id            -2.566e-01  2.267e-01 -1.132 0.260106
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 171.4 on 119 degrees of freedom
## (182 observations deleted due to missingness)
## Multiple R-squared:  0.2549, Adjusted R-squared:  0.09206
## F-statistic: 1.565 on 26 and 119 DF,  p-value: 0.0557
```

The linear regression model above shows that fertiliser bags and type have the most significance to the yields per kgs. Other factors have very low influence if any at all.

3. Out of the survey sample (cryield table), what is the proportion of farmers who reported bad/good crop yields and received (or did not receive) an insurance payout?

```
## Warning in chisq.test(payoutsselect): Chi-squared approximation may be
## incorrect
##
## Pearson's Chi-squared test
##
## data:  payoutsselect
## X-squared = 2935700, df = 654, p-value < 2.2e-16
```

We can thus see an apparent association between crop yields and payouts. The test results show that relying on the distribution of the test statistic might lead to some inaccuracies so I have included the code that removes this reliance. It takes a little bit of time to run.

4. At the district level, can we say that districts with poorer (or better) harvests received higher (or lower) insurance payout amounts?

```
## Warning in chisq.test(districtpayouts): Chi-squared approximation may be
## incorrect
##
## Pearson's Chi-squared test
##
## data:  districtpayouts
## X-squared = 380280, df = 654, p-value < 2.2e-16
```

The payouts across districts seem to have a correlation to the yields.

5. Can we trust the quality of our Y2019 sampled data?

```
##
## Two Sample t-test
##
## data: cryield$planted_acres and customers$farm_size
## t = -11.653, df = 233, p-value < 2.2e-16
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -9.323538 -6.626783
## sample estimates:
## mean of x mean of y
## 4.358173 12.333333
```

As we have a p-value that's less than 0.05 we can estimate that the survey is a proper representation of the population.

```
sessionInfo()
```

```
## R version 3.5.3 (2019-03-11)
## Platform: x86_64-pc-linux-gnu (64-bit)
## Running under: Ubuntu 16.04.6 LTS
##
## Matrix products: default
## BLAS: /opt/microsoft/roper/3.5.3/lib64/R/lib/libRblas.so
## LAPACK: /opt/microsoft/roper/3.5.3/lib64/R/lib/libRlapack.so
##
## locale:
##  [1] LC_CTYPE=en_US.UTF-8      LC_NUMERIC=C
##  [3] LC_TIME=en_US.UTF-8      LC_COLLATE=en_US.UTF-8
##  [5] LC_MONETARY=en_US.UTF-8  LC_MESSAGES=en_US.UTF-8
##  [7] LC_PAPER=en_US.UTF-8     LC_NAME=C
##  [9] LC_ADDRESS=C             LC_TELEPHONE=C
## [11] LC_MEASUREMENT=en_US.UTF-8 LC_IDENTIFICATION=C
##
## attached base packages:
## [1] stats      graphics  grDevices  utils      datasets  methods    base
##
## other attached packages:
##  [1] forcats_0.4.0      stringr_1.4.0      dplyr_0.8.0.1
##  [4] purrr_0.3.2        readr_1.3.1        tidyr_0.8.3
##  [7] tibble_2.1.1       ggplot2_3.1.1      tidyverse_1.2.1
## [10] RevoUtils_11.0.3    RevoUtilsMath_11.0.0
##
## loaded via a namespace (and not attached):
##  [1] tidyselect_0.2.5  xfun_0.6           reshape2_1.4.3     ggthemes_4.1.1
##  [5] haven_2.1.0       lattice_0.20-38    colorspace_1.4-1   generics_0.0.2
##  [9] htmltools_0.3.6   yaml_2.2.0         utf8_1.1.4         rlang_0.3.4
## [13] pillar_1.3.1      glue_1.3.1         withr_2.1.2        modelr_0.1.4
## [17] readxl_1.3.1      plyr_1.8.4         munsell_0.5.0      gtable_0.3.0
## [21] cellranger_1.1.0  rvest_0.3.3        evaluate_0.13      labeling_0.3
## [25] knitr_1.22        fansi_0.4.0        broom_0.5.2        Rcpp_1.0.1
## [29] scales_1.0.0      backports_1.1.4    jsonlite_1.5       hms_0.4.2
## [33] digest_0.6.18     stringi_1.4.3      grid_3.5.3         cli_1.1.0
## [37] tools_3.5.3       magrittr_1.5       lazyeval_0.2.2     crayon_1.3.4
```

```
## [41] pkgconfig_2.0.2  xml2_1.2.0      lubridate_1.7.4  assertthat_0.2.1
## [45] rmarkdown_1.12   httr_1.4.0      rstudioapi_0.10  R6_2.3.0
## [49] nlme_3.1-137     compiler_3.5.3
```